

NASA Technical Memorandum 86207

# Photographic Catalog of Selected Planetary Size Comparisons

Stephen Paul Meszaros

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# Photographic Catalog of Selected Planetary Size Comparisons

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National Aeronautics  
and Space Administration

**Scientific and Technical  
Information Branch**

1985







# **PHOTOGRAPHIC CATALOG OF SELECTED PLANETARY SIZE COMPARISONS**

by  
Stephen Paul Meszaros

## **ABSTRACT**

This publication utilizes photographs taken by NASA spacecraft, and cartographic products based on these photos, to illustrate size comparisons of the planets and moons of the solar system. It depicts both global views and prominent geographical features at the same scale, allowing size relationships to be studied visually.







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# PHOTOGRAPHIC CATALOG OF SELECTED PLANETARY SIZE COMPARISONS

## INTRODUCTION

Over the past two decades NASA spacecraft have visited many of the planets and moons of the solar system. Out of these missions has come a wealth of scientific data and detailed photographs. Accurate size measurements of the planets and moons, and their surface features, is one of the most basic types of information to result from this exploration program.

The photographs presented in this publication show planet and moon global views and selected geographical features at the same scale, within each picture. This will allow size relationships to be studied visually. Whenever possible, original spacecraft photos were used. However, when this was not feasible because of scale, quality, or availability factors, airbrush maps were substituted. In a few cases artist renderings and estimated sizes are used for worlds not yet reached by spacecraft.

The publication is divided into three parts. Part I contains all the picture captions while Part II contains the pictures. The picture captions and pictures are similarly numbered. Thus, caption number 1 explains picture number 1, caption number 10 explains picture number 10, etc. Global views of the planets and moons (in groups) are shown first. This is followed by each of the planets (and its respective moon(s)) in order, from the nearest to the sun outward. Various geographical comparisons are made in each case. Since not all of the illustrations fit easily into this categorization, cross references are included in the picture captions of Part I. Part III, the Bibliography, contains books that were selected especially for their lucid descriptions and/or their photographic content.

All the illustrations in this publication are available for purchase (as photo prints, slides, vugraphs, etc.) using the "H" or "HC" number designation included with each picture. ("H" indicates that the picture is available in black and white, "HC" indicates that it is available in color. Some pictures are available both ways.) For information write:

Audio-Visual Branch, Code LFD-10  
National Aeronautics and Space Administration  
Washington, D.C. 20546

Educators and scientists may also obtain photo products from the National Space Science Data Center. For information contact:

National Space Science Data Center, Code 633  
Goddard Space Flight Center  
Greenbelt, Maryland 20771

In addition, the U.S. Geological Survey has produced a large number of maps, at various scales, of many of the planets and moons in the solar system. For information and a list of the maps available write:

National Cartographic Information Center  
U.S. Geological Survey  
507 National Center  
Reston, Virginia 22092

Part I

PHOTOGRAPH CAPTIONS



## PLANETS AND MOONS

**Photo 1** **83 H 201**  
**83 HC 201**

This montage of photographs taken by various NASA spacecraft displays the smaller planets and larger moons of the solar system at the same scale. The inner planets Mercury, Venus, Earth, Mars, and the Earth's moon are shown, as well as Jupiter's large satellites Io, Europa, Ganymede, and Callisto, and Saturn's large moon Titan. In the case of the Earth and Mars we are looking through relatively thin atmospheres to the surfaces below. Venus and Titan have deep atmospheres so only their cloud tops are visible. Mercury, the Earth's moon, Io, Europa, Ganymede, and Callisto have essentially no atmospheres, so their varied surface features can be seen directly.

### Diameters:

Earth	12,756 kilometers (7,927 miles)
Venus	12,104 kilometers (7,521 miles)
Mars	6,796 kilometers (4,223 miles)
Mercury	4,878 kilometers (3,031 miles)
Moon	3,476 kilometers (2,160 miles)
Io	3,632 kilometers (2,257 miles)
Europa	3,126 kilometers (1,942 miles)
Ganymede	5,276 kilometers (3,279 miles)
Callisto	4,820 kilometers (2,995 miles)
Titan	5,150 kilometers (3,200 miles)

## GIANT PLANETS

**Photo 2** **83 H 202**  
**83 HC 202**

The solar system's two largest planets are compared with the Earth in this montage. Unlike the Earth, Jupiter and Saturn are giant worlds composed primarily of hydrogen and helium. Beneath the cloud tops, the atmospheres change from a gaseous to a liquid form with increasing depth. There may be small rocky cores in the dense centers of these planets. Jupiter is approximately 11 times the diameter of the Earth and Saturn is about 9 times the diameter of our world.

### Diameters:

Jupiter	142,796 kilometers (88,733 miles)
Saturn	120,660 kilometers (74,978 miles)
Earth	12,756 kilometers (7,927 miles)

## LARGE PLANETS

**Photo 3** **83 H 203**  
**83 HC 203**

The large planets Uranus and Neptune are shown at the same scale as the Earth. Since they are very distant worlds and no spacecraft has yet reached them, these are artist's concepts of the way we believe they would appear.

### Diameters:

Uranus	50,800 kilometers (31,567 miles)
Neptune	48,600 kilometers (30,200 miles)
Earth	12,756 kilometers (7,927 miles)

## LARGE MOONS

**Photo 4** **83 H 204**  
**83 HC 204**

The large moons of the solar system that have been photographed by NASA spacecraft are shown in this montage. Earth's moon, with a diameter of 3,476 kilometers (2,160 miles), is shown at the center. Io, Europa, Ganymede, and Callisto are satellites of Jupiter; Titan is a satellite of Saturn. Ganymede is the largest, with a diameter of 5,276 kilometers (3,279 miles). (Photo of Earth's moon courtesy of Lick Observatory.)

### Diameters:

Moon	3,476 kilometers (2,160 miles)
Io	3,632 kilometers (2,257 miles)
Europa	3,126 kilometers (1,942 miles)
Ganymede	5,276 kilometers (3,279 miles)
Callisto	4,820 kilometers (2,995 miles)
Titan	5,150 kilometers (3,200 miles)

(See also Photo Number 76.)

## MOONS OF SATURN

**Photo 5** **83 H 222**

The six medium-sized moons of Saturn are shown at the same scale as Earth's moon in this photo montage. While our moon is made of rock, these satellites of the "ringed planet" are composed predominantly of ice. (Photo of Earth's moon courtesy of Lick Observatory.)

### Diameters:

Earth's moon	3,476 kilometers (2,160 miles)
Mimas	392 kilometers (244 miles)

## Part I: PHOTOGRAPH CAPTIONS

Enceladus	500 kilometers (311 miles)
Tethys	1,060 kilometers (659 miles)
Dione	1,120 kilometers (696 miles)
Rhea	1,530 kilometers (951 miles)
Iapetus	1,460 kilometers (907 miles)

(See also Photo Number 96.)

### SMALL MOONS

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<b>Photo 6</b>	<b>83 H 224</b>
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Some of the smaller moons of Jupiter and Saturn are pictured here at the same scale. They are generally irregular in shape since their gravities are too weak to pull them into spheres.

### THE MOONS OF MARS

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<b>Photo 7</b>	<b>83 H 225</b>
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Photographs of the Martian moons, Phobos and Deimos, taken by Viking Orbiter 1. The satellites are very irregular in shape but are roughly 22 kilometers (14 miles) and 12 kilometers (7 miles) in size respectively.

(See also Photo Number 68.)

### PLANETARY COMPARISONS #1

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<b>Photo 8</b>	<b>85 H 52</b>
	<b>85 HC 50</b>

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Planets and moons of the solar system are shown at the same scale, within two size groupings. The upper group shows Jupiter, Saturn, and the Earth at the same scale. The lower group shows the Earth, Venus, Mars, Mercury, and the Earth's moon; Io, Europa, Ganymede, and Callisto are moons of Jupiter; Titan is a moon of Saturn.

### PLANETARY COMPARISONS #2

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<b>Photo 9</b>	<b>85 H 53</b>
	<b>85 HC 51</b>

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Selected planets and moons of the solar system are shown at the same scale, within two size groupings. The

left group shows the Earth, Venus, Mars, Mercury, and the Earth's moon; Io, Europa, Ganymede, and Callisto are moons of Jupiter; Titan is the large moon of Saturn. The right group shows the Earth's moon compared with the medium-sized moons of Saturn - Mimas, Enceladus, Tethys, Dione, Rhea, and Iapetus.

### PLANETARY COMPARISONS #3

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<b>Photo 10</b>	<b>85 H 54</b>
	<b>85 HC 52</b>

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Planets and moons of the solar system are shown at the same scale, within three size groupings. The upper left group shows Jupiter, Saturn, and the Earth. The lower central group shows the Earth, Venus, Mars, Mercury, the Earth's moon, Jupiter's larger satellites (Io, Europa, Ganymede, and Callisto), and Saturn's largest satellite (Titan). The upper right group shows the Earth's moon compared with the medium-sized moons of Saturn (Mimas, Enceladus, Tethys, Dione, Rhea, and Iapetus).

### MID-SIZED PLANETS AND LARGE MOONS

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<b>Photo 11</b>	<b>85 H 56</b>
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This montage of photographs displays smaller planets and larger moons of the solar system at the same scale. The inner planets Mercury, Venus, Earth, Mars, and the Earth's moon are shown, as well as Jupiter's large satellites Io, Europa, Ganymede, and Callisto, and Saturn's large moon Titan. The planet Pluto and Neptune's large moon Triton are also sketched at their estimated sizes. No spacecraft has yet visited these worlds, so their exact sizes and appearances are unknown.

### FOUR LARGE PLANETS

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<b>Photo 12</b>	<b>85 H 55</b>
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The solar system's four largest planets are compared with the Earth in this photo montage. Since no spacecraft has yet visited Uranus and Neptune, these are artists's concepts of the way we believe they would appear. (The Voyager 2 spacecraft is scheduled to fly past Uranus in 1986 and Neptune in 1989.)

## OTHER DESTINATIONS

**Photo 13** **83 H 256**

Other possible destinations of exploratory spacecraft are shown at the same scale as the Earth's moon. (Sizes are the best determination as of 1980.) They include: the moons of Uranus (Miranda, Ariel, Umbriel, Oberon, Titania), the moons of Neptune (Nereid, Triton), the small planet Pluto and its moon (Charon), and the largest asteroid (Ceres). (Photo of Earth's moon courtesy of Lick Observatory.)

## RADAR VIEWS: EARTH, VENUS, MARS

**Photo 14** **83 H 207**  
**83 HC 207**

Maps of the Earth, Venus, and Mars are shown at the same scale. The surface topography of all three planets is displayed at the same radar resolution as that achieved by the Pioneer-Venus spacecraft.

(See also Photo Numbers 29 and 42.)

## THE SURFACES OF MARS AND VENUS

**Photo 15** **83 H 255**

This comparison shows panoramic views of the surface of Mars from the American Viking spacecraft and the surface of Venus from the Soviet Venera spacecraft.

(See also Photo Numbers 32 and 70.)

## TECTONIC FEATURE COMPARISONS

**Photo 16** **84 H 428**

This graph compares the lengths of several canyons and rift zones in the solar system. Valles Marineris, the great canyon system of Mars, is probably the largest such feature in the solar system. The African Rift Zone is a series of faults that run generally north and south in East Africa. Ithaca Chasma is the canyon that stretches around much of the circumference of Tethys, a moon of Saturn. The Grand Canyon of Arizona, while basically a fluvial rather than structural feature, is included for comparison because it is so well-known.

## CRATER COMPARISONS

**Photo 17** **84 H 422**

This visual compares several large craters in the solar system. The craters Herschel and Odysseus are solitary features on Saturn's moons Mimas and Tethys. Herschel has a diameter of 140 kilometers (87 miles) while the diameter of Odysseus is 430 kilometers (267 miles). The other two craters, Copernicus and Clavius, are well-known features on the near side of the Earth's moon. Copernicus is 90 kilometers (56 miles) in diameter. Clavius has an overall size of 234 kilometers (145 miles). Also shown, at the same scale, is the Manicouagan structure of Canada. This is believed to be an ancient impact scar formed about 210 million years ago. Visible in the photograph is the ice-covered surface of its circular lake, approximately 66 kilometers (41 miles) in diameter.

(See also Photo Number 39.)

## IMPACT BASINS COMPARED

**Photo 18** **84 H 423**

Large impact basins of the solar system are compared at the same scale. Shown are basins on Mercury, the moon, Mars, and Callisto (a moon of Jupiter).

## VOLCANOES COMPARED

**Photo 19** **84 H 426**

The huge volcanoes of Mars and Io (a moon of Jupiter) are shown at the same scale. They are compared with the Hawaiian Islands, one of the largest volcanic features on the Earth.

(See also Photo Numbers 54 through 59 and 79.)

## OVERALL COMPARISONS (#1)

**Photo 20** **84 H 431**

This illustration compares many of the larger geographical features in the solar system at the same scale. Shown are features on Mercury, the moon, Mars, Io and Callisto (moons of Jupiter), and Iapetus (a moon of Saturn.) Caloris, Imbrium, Orientale, Argyre, Hellas, Asgard, and

## Part I: PHOTOGRAPH CAPTIONS

Valhalla are impact basins. Olympus Mons and Pele are volcanoes. Valles Marineris is a canyon system. Cassini Regio is a dark-toned feature of unknown origin.

### OVERALL COMPARISONS (#2)

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**Photo 21** **85 H 69**

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This diagram compares the geographical features shown in photo number 20 with the United States, at the same scale.

### MERCURY

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**Photo 22** **83 H 260**

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Mercury as seen by the Mariner 10 spacecraft. The incoming and outgoing views are shown.

### MERCURY

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**Photo 23** **74 H 253**  
**85 HC 48**

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The Mariner 10 spacecraft obtained this view of Mercury during its out-going pass on March 29, 1974. This photo-mosaic has been tinted (in the color version) to approximate the visual appearance of Mercury.

### MERCURY AND EARTH

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**Photo 24** **83 H 227**

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Mercury and Earth at the same scale.

#### Diameters:

Mercury	4,878 kilometers (3,031 miles)
Earth	12,756 kilometers (7,927 miles)

### THE CALORIS BASIN (#1)

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**Photo 25** **84 H 420**

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The Caloris Basin is a huge impact structure on the planet Mercury. It has a diameter of approximately 1,300 kilometers (800 miles). The outer ring of mountains that

defines its form rises 2 to 3 kilometers (1 to 2 miles) in elevation. On the floor of the basin are numerous ridges and cracks that are concentric and/or radial to the impact center.

In the photo mosaic only about half of the Caloris Basin is visible; the other half was in darkness during the picture-taking flybys of the Mariner 10 spacecraft. It remains for a future spaceprobe to image the unseen part of this vast feature.

### THE CALORIS BASIN (#2)

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**Photo 26** **83 H 241**

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The immense size of the Caloris Basin on Mercury is shown in this comparison. 1300 kilometers (800 miles) in diameter, it could easily hold the state of Texas. The basin was caused by the violent impact of a large asteroid several billion years ago.

### VENUS

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**Photo 27** **83 H 212**  
**83 HC 212**

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Venus as seen by the Pioneer-Venus spacecraft. A star background has been added by an artist.

### VENUS AND EARTH

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**Photo 28** **83 H 228**

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Venus and the Earth at the same scale.

#### Diameters:

Venus	12,104 kilometers (7,521 miles)
Earth	12,756 kilometers (7,927 miles)

### RADAR VIEWS: EARTH AND VENUS

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**Photo 29** **83 H 206**  
**83 HC 206**

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Maps of the Earth and Venus are shown at the same scale. The surface topography of both planets is displayed at the same radar resolution as that achieved by the Pioneer-Venus spacecraft.

(See also Photo Number 14.)

## ISHTAR TERRA

**Photo 30** **83 H 242**

One of the large upland areas or "continents" on the planet Venus is shown at the same scale as the United States. Named Ishtar Terra, its outlines were delineated by radar from the Pioneer-Venus spacecraft. Mount Maxwell on Ishtar Terra rises to an elevation higher than Mount Everest on the Earth.

## VENERA LANDING SITES

**Photo 31** **83 H 259**

The Soviet Venera landing sites where surface photos were taken on Venus are shown. V9 stands for Venera Lander 9, V10 for Venera 10, V13 for Venera 13, and V14 for Venera 14.

## THE SURFACE OF VENUS

**Photo 32** **83 H 254**

Wideangle views of the surface of Venus from the Soviet Venera 9, 10, 13, and 14 lander spacecraft.

(See also Photo Number 15.)

## EARTH

**Photo 33** **83 H 213**  
**83 HC 213**

Earth as seen from the Apollo 17 spacecraft. A star background has been added by an artist.

## EARTH AND MOON

**Photo 34** **83 H 229**

The Earth and the moon at the same scale. (Moon photo courtesy of Lick Observatory.)

### Diameters:

Earth	12,756 kilometers (7,927 miles)
Moon	3,476 kilometers (2,160 miles)

## EARTHRISE

**Photo 35** **85 H 51**  
**85 HC 49**

The Earth as seen rising above the horizon of the moon by the astronauts of Apollo 15. (A star background has been added by an artist, since the actual stars do not show up in this photograph.) This picture, probably more than any other, captures the spirit of man's venture beyond his world and into the universe.

## APOLLO LANDING SITES

**Photo 36** **83 H 257**

The lunar landing sites of the Apollo program are shown. (Photo of Earth's moon courtesy of Lick Observatory.)

## THE ORIENTALE BASIN

**Photo 37** **83 H 243**

The Orientale Basin is an impact basin located on the extreme western limb of the moon. Because of this position, it is very difficult to observe from the Earth and only limited studies could be made of the feature. It took a spacecraft to reveal Orientale's true nature. As this lunar orbiter satellite photograph shows, the basin has the form of a huge bull's-eye, 900 kilometers (560 miles) in diameter. The outer ring has been named the Cordillera Mountains while the inner rings are called the Rook Mountains. The center of the basin has been flooded by dark mare lavas. Orientale is the youngest and best-preserved of the large impact basins on the moon. As this illustration demonstrates, it is as large as the State of Texas.

## THE CHANNELED SCABLANDS

**Photo 38** **76 HC 226**

The Channeled Scablands occur in the eastern part of the State of Washington. They are characterized by scoured terrain, indicative of one of the greatest floods ever known on Earth. The Spokane Flood, which created the Scablands, had its origin 18,000 to 20,000 years ago during the Great Ice Age. At that time the ice sheet dammed several rivers, creating a number of lakes, the largest being glacial Lake Missoula. This lake grew to a depth, at the ice dam, of



## Part I: PHOTOGRAPH CAPTIONS

almost 600 meters (2,000 feet) and had a volume equal to half that of present-day Lake Michigan. When the dam gave way, an immense amount of water coursed downstream. It has been calculated that the maximum rate of flow was 65 times the rate of flow of the world's largest river, the Amazon. Water poured across the landscape in depths of 180 meters (600 feet) or more and made its way to the Pacific Ocean over a distance of 885 kilometers (550 miles). Lake Missoula was probably drained in just a few days and the scoured terrain the flood produced is readily apparent in the Channeled Scablands today. The photograph shows this area as seen from a Landsat satellite in Earth orbit. For a comparison of the Channeled Scablands with Martian flood features, see Photo Number 64.

### MANICOUAGAN STRUCTURE

**Photo 39** **76 HC 260**

The Manicouagan Structure of Canada was apparently formed by an asteroid impact approximately 210 million years ago. A circular lake, here covered with ice, delineates the feature. In size it is 66 kilometers (41 miles) in diameter. For a comparison with other planetary impact features, see Photo Number 17.

### MARS

**Photo 40** **83 H 214**  
**83 HC 214**

Mars as seen by the Viking spacecraft. A star background has been added by an artist.

### MARS AND EARTH

**Photo 41** **83 H 230**

Mars and the Earth at the same scale.

#### Diameters:

Mars	6,796 kilometers (4,223 miles)
Earth	12,756 kilometers (7,927 miles)

## MARS AND EARTH

**Photo 42** **84 H 593**

These two Mercator map projections display the generalized topographic surfaces of Mars and the Earth at the same scale. It is readily apparent that Mars has much less total area than the Earth, but note that Mars has almost the same area as the Earth's continents combined.

(See also Photo Number 14.)

### SELECTED MARTIAN LANDFORMS

**Photo 43** **84 H 594**

This map shows the locations of selected Martian landforms and also the Viking 1 and Viking 2 spacecraft landing sites.

### VALLES MARINERIS (#1)

**Photo 44** **83 H 244**

Valles Marineris, the huge canyon of Mars, would stretch entirely across the United States - a distance of about 5,000 kilometers (3,000 miles).

### VALLES MARINERIS (#2)

**Photo 45** **84 H 596**

Named after the Mariner 9 spacecraft that discovered it, Valles Marineris is a huge canyon system on Mars. It extends in an easterly direction for about 5,000 kilometers (3,000 miles). If placed on the United States, Valles Marineris would stretch from New York City to Los Angeles (See Photo Number 46). It has a width of approximately 240 kilometers (150 miles) and depths up to 6.5 kilometers (4 miles).

The origin of Valles Marineris is not known, but it is apparently a tectonic feature of vast proportions. Perhaps it represents an area of incipient plate tectonics which occurred during an earlier period in Martian history. (This is an airbrush map version.)

**VALLES MARINERIS (#3)****Photo 46****84 H 595**

Valles Marineris compared to the United States (airbrush map version).

**VALLES MARINERIS AND  
THE GRAND CANYON****Photo 47****75 H 495**

The Valles Marineris canyon system on Mars is compared with the Grand Canyon in Arizona. As is readily apparent, the Grand Canyon is only the size of one of the tributary canyons of Valles Marineris.

**THE THARSIS BULGE (#1)****Photo 48****84 H 427**

The Tharsis Bulge (also known as the Syria Rise) is an enormous elevated region of the Martian crust. It is roughly 5,000 kilometers (3,000 miles) across and has an elevation of around 7 kilometers (4 miles). The Bulge fills much of this picture. Fractures radiate outward from it in all directions, including the Valles Marineris canyon system (to the east). Above the Tharsis, in a line, rise the huge volcanoes Ascraeus Mons, Pavonis Mons, and Arsia Mons (north-east to south-west). Olympus Mons lies on the northwest edge of the Bulge. All four of these great volcanoes penetrate over 26 kilometers (16 miles) into the Martian sky. The reason for the existence of the Tharsis Bulge is not well understood, but as a massive tectonic feature, it undoubtedly has had a major influence upon Mars as a planet. (This is an airbrush map version.)

**THE THARSIS BULGE (#2)****Photo 49****84 H 597**

The Tharsis Bulge compared to the United States (airbrush map version).

**THE THARSIS BULGE (#3)****Photo 50****83 H 245**

The immense volcanoes in this airbrush map make up part of the Tharsis Bulge, an elevated area on the Martian surface. The volcanoes rise over 26 kilometers (16 miles) in altitude. Their extent is indicated by the outline of the East Coast, which is shown at the same scale.

**THE THARSIS BULGE (#4)****Photo 51****84 H 599**

The immense volcanoes in this airbrush map make up part of the Tharsis Bulge, an elevated area on the Martian surface. The volcanoes rise over 26 kilometers (16 miles) in altitude. Their extent is indicated by the outline of the West Coast, which is shown at the same scale.

**THE THARSIS BULGE (#5)****Photo 52****85 H 57**

The three huge Martian volcanoes of the Tharsis Bulge, Ascraeus Mons, Pavonis Mons, and Arsia Mons, are compared - at the same scale - with the states of the West Coast. Also shown are several well-known West Coast volcanoes. It is dramatically apparent that these Martian volcanoes are much larger than their counterparts on the Earth.

**THARSIS BULGE (#6) CROSS SECTIONS****Photo 53****84 H 598**

Two cross sections are shown across the Tharsis Bulge. Also shown, at the same scale, are several well-known terrestrial volcanoes. This diagram indicates the truly immense size of the Martian volcanoes.

(See also Photo Number 59.)

### OLYMPUS MONS (#1)

**Photo 54** **83 H 249**

Olympus Mons is the largest single volcano in the known solar system. Located on Mars, this huge mountain is approximately 650 kilometers (400 miles) wide and rises over 26 kilometers (16 miles) into the thin Martian atmosphere. At its top is a complex caldera 80 kilometers (50 miles) across. Lava flows may be traced down its sides and over a 4 kilometer (2.5 mile) high scarp at its base. The origin of this scarp is unknown. Beyond the scarp, lava flows and other types of terrain associated with the volcano extend for hundreds of kilometers across the Martian plains.

It is thought that Olympus Mons has grown so large because it has remained stationary over its lava source. (On the Earth plate movement does not allow this; terrestrial volcanoes, such as the Hawaiian Islands, can only achieve moderate size before they are shifted from their source regions and become extinct.) Thus, Olympus Mons has been able to slowly increase in size for perhaps over a billion years.

### OLYMPUS MONS (#2)

**Photo 55** **84 H 424**

An airbrush map version of Olympus Mons.

### OLYMPUS MONS (#3)

**Photo 56** **83 H 247**

Olympus Mons compared with the State of Arizona.

### OLYMPUS MONS (#4)

**Photo 57** **83 H 246**

Olympus Mons compared with Arizona (airbrush map version).

### OLYMPUS MONS (#5)

**Photo 58** **83 H 248**

Olympus Mons compared with the Northeast United States.

### MAJOR MOUNTAINS COMPARED: EARTH AND MARS

**Photo 59** **84 H 425**

The highest mountains on the Earth and Mars are compared in this diagram. Olympus Mons may have the highest vertical relief of any mountain in the solar system. Mount Everest is Earth's loftiest peak when measured from sea level. However, the volcano Mauna Kea on Hawaii is the Earth's highest, when measured from base to top. Much of Mauna Kea lies under the Pacific Ocean, with only 4 kilometers (2.5 miles) above sea level.

(See also Photo Number 53.)

### HELLAS AND ARGYRE

**Photo 60** **84 H 600**

Hellas and Argyre are two immense basins found in the southern hemisphere of Mars. They were apparently caused by the impacts of asteroids about 4 billion years ago. Hellas has a diameter of approximately 2,000 kilometers (1,200 miles) while Argyre has a diameter of 1,200 kilometers (750 miles). This illustration shows how these two basins compare in size with the United States. Hellas would cover most of the Western states and Argyre would extend over a large portion of the Eastern section of the country.

(See also Photo Number 43.)

### CATASTROPHIC FLOODS OF MARS (#1)

**Photo 61** **85 H 58**

One of the great discoveries of the Mariner 9 spacecraft was the existence of channels on Mars. There are several types, but the largest and most impressive are the outflow channels. These are features that generally start in jumbled

terrain, emerge full size, and flow out onto the plains where they gradually disappear. The unusual thing about these channels is their vast size. They may achieve widths of over 200 kilometers (125 miles) and lengths in excess of 2,000 kilometers (1,200 miles). Although several theories have been put forward concerning their origin, the leading one proposes that these channels were caused by catastrophic floods of liquid water. How this could have happened is not clear, although it may have involved the sudden melting of permafrost and release of large volumes of underground water. Many of the outflow channels are geologically quite old and consequently indicate a greater amount of water available in the past. This could be a sign of long-term climatic changes on Mars.

This illustration shows part of the Chryse plain and the catastrophic flood topography that is associated with it.

### CATASTROPHIC FLOODS OF MARS (#2)

**Photo 62**

**85 H 59**

In this illustration arrows indicate the flow direction of several of the catastrophic floods. The location of the Viking 1 lander on the Chryse plains is indicated.

### CATASTROPHIC FLOODS OF MARS (#3)

**Photo 63**

**85 H 60**

This illustration demonstrates the huge size of the catastrophic flood features of the Chryse area by comparing them with the Northeast and Midwest U.S., at the same scale. As can be seen, some of these great floods would have covered entire states.

### CATASTROPHIC FLOODS OF MARS (#4)

**Photo 64**

**84 H 430**

This illustration is a mosaic of Viking spacecraft photographs showing an area of typical outflow channel terrain. The inset photo shows the Channeled Scablands of Washington's Columbia Plateau at the same scale. The Channeled Scablands are an extensive landform caused by flooding that occurred about 20,000 years ago. Since this landform represents one of the largest deluges known on Earth, its small size when compared to the catastrophic floods of Mars indicates how vast the Martian floods really were. (See also Photo Number 38.)

## THE POLAR REGIONS OF EARTH AND MARS

**Photo 65**

**84 H 603**

Like the Earth, Mars has polar caps that wax and wane with the seasons. Because of the much lower temperatures on Mars and the composition of its atmosphere (primarily carbon dioxide), most of its polar "snow" is actually a thin coating of carbon dioxide frost. However, spacecraft measurements have determined that the small residual ice cap that remains during the summer season in the northern hemisphere is actually made up of water ice. The same is probably true of the southern hemisphere ice cap.

This illustration compares the polar regions of Mars and the Earth at the same scale. In each case the ice caps are shown at approximately their minimum extent. This allows a direct comparison of water ice content. The residual north polar cap of Mars is considerably larger than its south polar cap, while the reverse is true on the Earth. Of course, the area of polar ice cover on the Earth is vastly greater than on Mars, reflecting the abundance of water available and the larger size of our planet. On the Earth ice depths of several kilometers may be found in some of the polar areas. On Mars the depth of the ice cover is unknown but it is undoubtedly quite thin by Earth standards. This again indicates the scarcity of water available on Mars, a desert world.

### NORTH POLAR REGIONS

**Photo 66**

**84 H 601**

The North Polar Regions of Earth and Mars compared.

### SOUTH POLAR REGIONS

**Photo 67**

**84 H 602**

The South Polar Regions of Earth and Mars compared.

### PHOBOS AND DEIMOS

**Photo 68**

**83 H 226**

Phobos and Deimos, the two small moons of Mars, are compared in size with Manhattan Island in New York City. They are very irregular in shape but are approximately 22 kilometers (14 miles) and 12 kilometers (7 miles) in diameter respectively. One theory for their origin is that they

## Part I: PHOTOGRAPH CAPTIONS

were once asteroids that have been captured by the gravitational attraction of Mars.

(See also Photo Number 7.)

### VIKING LANDING SITES

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**Photo 69** **83 H 258**

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The Viking landing sites on Mars are shown. V1 stands for Viking Lander 1 and V2 stands for Viking Lander 2.

### THE SURFACE OF MARS

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**Photo 70** **83 H 253**

---

These photographs are panoramic views of the surface of Mars as seen from the Viking 1 and Viking 2 lander spacecraft. The Viking 1 picture shows the presence of prominent sand dunes near the spacecraft while the terrain around Viking 2 has a more blocky appearance. Some deserts of Earth have landscapes that look very similar to the views in these photos.

(See also Photo Number 15.)

### JUPITER

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**Photo 71** **83 H 215**  
**83 HC 215**

---

Jupiter as seen by the Voyager spacecraft. A star background has been added by an artist.

### JUPITER AND EARTH

---

**Photo 72** **83 H 231**

---

Jupiter and the Earth at the same scale.

**Diameters:**

Jupiter	142,796 kilometers (88,733 miles)
Earth	12,756 kilometers (7,927 miles)

### THE GREAT RED SPOT

---

**Photo 73** **83 H 208**  
**83 HC 208**

---

The Earth is shown at the same scale as the Great Red Spot of Jupiter. The Red Spot is a huge storm that has been observed for hundreds of years in Jupiter's thick atmosphere. The reasons for its color and longevity are unknown.

### CLOUDS OF JUPITER

---

**Photo 74** **83 H 209**  
**83 HC 209**

---

The Earth seems to be serenely floating above the clouds of Jupiter in this photo composite. Since they are shown at the same scale, it is graphically apparent that many of the cloud features are as large as continents on the Earth. At the upper right is the Great Red Spot of Jupiter - a huge long-lived storm system.

### THE JOVIAN SYSTEM

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**Photo 75** **83 H 220**  
**83 HC 220**

---

This montage of images, prepared from Voyager 1 photographs taken in March, 1979, presents an artistic look at the Jovian System. Visible are Jupiter and its four large moons (top to bottom), Io, Europa, Ganymede, and Callisto. A star background has been added by an artist.

### MOONS OF JUPITER

---

**Photo 76** **83 H 205**  
**83 HC 205**

---

This is a composite photograph showing the different appearance of each of Jupiter's four largest moons. They are shown approximately to scale, the diameters being: Io, 3,632 kilometers (2,257 miles); Europa, 3,126 kilometers (1,942 miles); Ganymede, 5,276 kilometers (3,279 miles); and Callisto, 4,820 kilometers (2,995 miles). For comparison, the diameter of Earth's moon is 3,476 kilometers (2,160 miles).

(See also photo Number 4.)



## JUPITER'S MOONS – CLOSEUP

---

**Photo 77**
**83 H 210  
83 HC 210**


---

These four views show the great surface variety present on Jupiter's large satellites. We see volcanic deposits on Io, ice fractures on Europa, grooved terrain on Ganymede, and impact basins on Callisto. The relative ages of these surfaces range from Io, the youngest, through Europa and Ganymede, to Callisto, the oldest.

## IO AND THE MOON

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**Photo 78**
**83 H 236**


---

Jupiter's moon Io and the Earth's moon at the same scale. (Photo of Earth's moon courtesy of Lick Observatory.)

### Diameters:

Io	3,632 kilometers (2,257 miles)
Moon	3,476 kilometers (2,160 miles)

## PELE

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**Photo 79**
**85 H 61**


---

The Voyager spacecraft found Jupiter's moon Io to be the most active volcanic body in the solar system. The largest erupting feature of the many observed was named Pele, which appears as a heart-shaped feature in the center of the photograph. Actually a large volcanic landform is not present; what we see is a dark-colored vent of relatively low relief in the center. The heart-shaped feature is the plume of material being erupted at high velocity from the vent and falling back to the surface of Io. When photographed by the Voyager 1 spacecraft, this plume reached elevations of 280 kilometers (175 miles) above the surface. Io is extremely active geologically because of tidal stretching. This is caused by its somewhat elliptical orbit, a result of perturbations by the nearby moon Europa. The volcanoes apparently erupt such materials as sulfur and sulfur dioxide. This constant activity by a dozen or more vents keeps the surface very young in character. Indeed, no impact craters have been discovered; they have all been rapidly buried by the erupted material.

In this illustration Pele is compared, at the same scale, with the states of Arizona, New Mexico, Colorado, and Utah. As can be seen, the immense volcanic plume would cover most of these four large states.

## EUROPA AND THE MOON

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**Photo 80**
**83 H 237**


---

Jupiter's moon Europa and the Earth's moon at the same scale. (Photo of Earth's moon courtesy of Lick Observatory.)

### Diameters:

Europa	3,126 kilometers (1,942 miles)
Moon	3,476 kilometers (2,160 miles)

## EUROPA COMPARED WITH THE U.S.

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**Photo 81**
**85 H 62**


---

One of Jupiter's four large Galilean Satellites – Europa – is compared, at approximately the same scale, with the United States. The surface of Europa is very level and is crisscrossed by many linear features. As can be seen from this illustration, some of these features would stretch across a major portion of the U.S. Europa's surface is composed predominantly of ice and the linear features are apparently ice related. It is thought that a thin ice crust may overlie an ocean perhaps 100 kilometers (60 miles) deep on this strange moon.

## EUROPA AND ENCELADUS

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**Photo 82**
**84 H 429**


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Europa, a moon of Jupiter, and Enceladus, a moon of Saturn, are shown at the same scale. Europa has a diameter of 3,126 kilometers (1,942 miles) while the diameter of Enceladus is 500 kilometers (311 miles). The surface of Europa is crisscrossed by hundreds of long thin lines. It is thought that they are cracks in an icy surface which may overlie an ocean up to 100 kilometers (60 miles) deep. There are very few craters present. Enceladus is primarily water ice in composition. It has some cratered regions but it also has areas with flow features that are essentially devoid of craters. The scarcity of craters on Europa and parts of Enceladus indicates that they have been resurfaced. Such resurfacing might be the result of interior heating caused by radioactive decay. This, however, is questionable for Europa and especially so for Enceladus because of their small size. Perhaps heating due to tidal forces – similar to that which causes the volcanoes on Io – is the process that renews the surfaces of the moons. This is only one of the mysteries to be solved about these worlds which have the highest albedos (reflected brightness) yet discovered in the solar system.

## GANYMEDE AND THE MOON

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**Photo 83** **83 H 238**

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Jupiter's moon Ganymede and the Earth's moon at the same scale. (Photo of Earth's moon courtesy of Lick Observatory.)

### Diameters:

Ganymede	5,276 kilometers (3,279 miles)
Moon	3,476 kilometers (2,160 miles)

## REGIONS OF GANYMEDE AND ENCELADUS COMPARED

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**Photo 84** **85 H 63**

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Regions of Jupiter's moon Ganymede and Saturn's moon Enceladus are compared at the same scale. The ridges apparent on both moons were caused by tectonic forces. Those on Enceladus, however, appear to have been formed more recently than those on Ganymede. In size, Ganymede has a diameter of 5,276 kilometers (3,279 miles) while the diameter of Enceladus is 500 kilometers (311 miles).

## CALLISTO AND THE MOON

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**Photo 85** **83 H 239**

---

Jupiter's moon Callisto and the Earth's moon at the same scale. (Photo of Earth's moon courtesy of Lick Observatory.)

### Diameters:

Callisto	4,820 kilometers (2,995 miles)
Moon	3,476 kilometers (2,160 miles)

## VALHALLA

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**Photo 86** **85 H 64**

---

Valhalla is a huge impact structure on Callisto, one of the large moons of Jupiter. It is compared in size with the United States in this illustration. The topography of Valhalla is different from that of basins on the inner planets. Here we see a bright patch at the center surrounded by discontinuous concentric rings, all of relatively low vertical relief. The apparent cause of this type of terrain is the actual composition of Callisto. The crust of this moon is made up of water ice which over long periods of time

flowed like a huge glacier. Thus the surface material was not strong enough to support the high mountains caused by the impact. The result is that this ancient impact structure looks lower today, like frozen ripples on a pond.

## JUPITER'S RING

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**Photo 87** **83 H 250**

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The ring of fine particles around Jupiter is shown in this photo composite. This ring is much smaller and dimmer than the brilliant rings around Saturn.

## SATURN

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**Photo 88** **83 H 216**  
**83 HC 216**

---

Saturn as seen by the Voyager spacecraft. A star background has been added by an artist.

## SATURN AND EARTH

---

**Photo 89** **83 H 232**

---

Saturn and the Earth at the same scale.

### Diameters:

Saturn	120,660 kilometers (74,978 miles)
Earth	12,756 kilometers (7,927 miles)

## SATURN AND THE EARTH-MOON DISTANCE

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**Photo 90** **85 H 65**

---

Saturn and its brighter rings are compared with the Earth-to-moon distance (approximately 240,000 miles or 386,000 kilometers) in this illustration. As can be readily seen, the rings of Saturn would almost span the distance from the Earth to the moon.

## THE RINGS OF SATURN (#1)

Photo 91

83 H 251

The Earth is shown at the same scale as the rings of Saturn. Although the brighter rings have a width about 5 times the Earth's diameter, their thickness is less than a hundred meters (a hundred yards).

## THE RINGS OF SATURN (#2)

Photo 92

83 H 211

83 HC 211

The Earth shown at the same scale as the rings of Saturn.

## SPOKES IN SATURN'S RINGS

Photo 93

83 H 252

Spokes in the rings of Saturn appear to form and dissipate as they move around the rings. They may appear bright or dark, as shown here, depending upon the direction from which they are viewed. It is thought that the spokes may be composed of very fine particles levitated above the main ring plane by electromagnetic forces.

## RINGED PLANET COMPARISONS

Photo 94

85 H 66

This diagram compares the rings of the three planets with known ring systems in the solar system. The Earth is also shown at the same scale. All three ring systems are very different in character. The main rings of Saturn (designated A, B, and C) are bright and are extremely complex in structure. Jupiter's ring is apparently composed of fine particles that may be slowly spiraling down into the cloud tops of the planet. The rings of Uranus are dark and thin in nature (they are exaggerated in width, in this sketch).

## THE SATURNIAN SYSTEM

Photo 95

83 H 221

83 HC 221

A montage of images prepared from Voyager 1 photos taken during November, 1980. Clockwise, the moons are as

follows: Dione (in front of Saturn), Enceladus, Rhea, Titan, Mimas, and Tethys. A star background has been added by an artist.

## THE MOONS OF SATURN

Photo 96

83 H 223

Saturn's large moon Titan and its medium sized moons are shown at the same scale in this composite. Titan is pictured as it would appear in size if its thick atmosphere were eliminated. With a diameter of 5,150 kilometers (3,200 miles) it is one of the largest moons in the solar system.

### Diameters:

Mimas	392 kilometers	(244 miles)
Enceladus	500 kilometers	(311 miles)
Tethys	1,060 kilometers	(659 miles)
Dione	1,120 kilometers	(696 miles)
Iapetus	1,460 kilometers	(907 miles)
Rhea	1,530 kilometers	(951 miles)
Titan	5,150 kilometers	(3,200 miles)

(See also Photo Number 5.)

## TITAN AND THE MOON

Photo 97

83 H 240

Saturn's moon Titan and the Earth's moon at the same scale. (Photo of Earth's moon courtesy of Lick Observatory.)

### Diameters:

Titan	5,150 kilometers (3,200 miles)
Moon	3,476 kilometers (2,160 miles)

## MIMAS AND TETHYS

Photo 98

84 H 421

Mimas and Tethys, two medium-sized moons of Saturn, are compared at the same scale. The diameter of Mimas is 392 kilometers (244 miles) and that of Tethys is 1,060 kilometers (659 miles). Each moon has an immense crater, fully one-third the size of its diameter. The impacts that caused these craters must have come close to destroying the moons. The crater on Mimas is named Herschel and is 140 kilometers (87 miles) in diameter, while the one on Tethys is called Odysseus and is 430 kilometers (267

## Part I: PHOTOGRAPH CAPTIONS

miles) in size. Herschel has a deep floor and a high central peak. Odysseus, on the other hand, is so large that its floor has rebounded into a more convex shape—to match the curvature of the satellite's surface.

### IAPETUS (#1)

**Photo 99**

**85 H 67**

Iapetus, with a diameter of 1,460 kilometers (907 miles), is one of the medium-sized moons of Saturn. It is also one of the most enigmatic bodies in the solar system. This is because of its strange duality of albedo. One hemisphere is as dark as asphalt while the other is as bright as newly-fallen snow. Since the dark hemisphere is exactly centered on the forward-facing side of Iapetus, one possibility is that its material is external in origin, having been swept up in orbit. On the other hand, some of the dark material seems to be located at the bottom of craters on the bright hemisphere. This indicates an internal origin, for material dropping onto the surface would not collect only in specific areas (like crater bottoms). Whatever the answer to this question may be, Iapetus remains one of the most mysterious of moons.

This map of Iapetus is centered on its dark forward-facing hemisphere, named Cassini Regio.

### IAPETUS (#2): CASSINI REGIO

**Photo 100**

**85 H 68**

This illustration compares the dark forward-facing hemisphere of Iapetus — named Cassini Regio — with the states of the central United States, at the same scale. As can be seen, Cassini Regio is a large feature that would cover many of the states.

### URANUS

**Photo 101**

**83 H 217  
83 HC 217**

An artist's concept of the planet Uranus and its rings.

### URANUS AND EARTH

**Photo 102**

**83 H 233**

Uranus and the Earth at the same scale. (Uranus is an artist's rendering.)

#### Diameters:

Uranus	50,800 kilometers (31,567 miles)
Earth	12,756 kilometers (7,927 miles)

### NEPTUNE

**Photo 103**

**83 H 218  
83 HC 218**

Neptune and its largest moon, Triton, as visualized by an artist.

### NEPTUNE AND EARTH

**Photo 104**

**83 H 234**

Neptune and the Earth at the same scale. (Neptune is an artist's rendering.)

#### Diameters:

Neptune	48,600 kilometers (30,200 miles)
Earth	12,756 kilometers (7,927 miles)

### PLUTO

**Photo 105**

**83 H 219  
83 HC 219**

Pluto and its moon, Charon, in an artist's view.

### PLUTO SIZE RANGE

**Photo 106**

**83 H 235**

The moon is compared with the possible size range of the planet Pluto. Since Pluto is so distant and no spacecraft has yet visited it, its exact size is imperfectly known. (Photo of Earth's moon courtesy of Lick Observatory.)

#### Diameters:

Pluto range	2,400 – 3,800 kilometers (1,490 – 2,360 miles)
Moon	3,476 kilometers (2,160 miles)

Part II

PHOTOGRAPHIC COMPARISONS

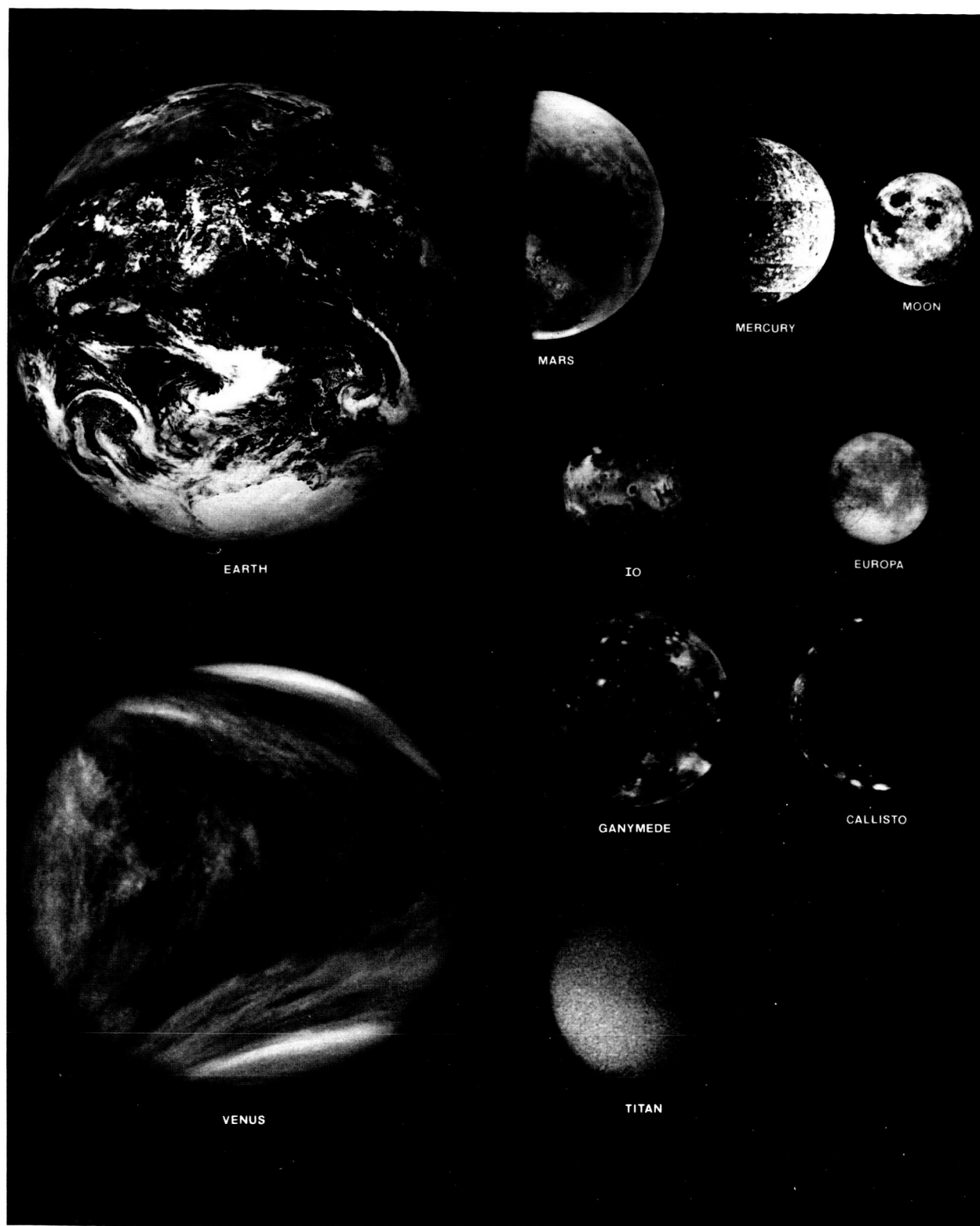


Photo 1 – PLANETS AND MOONS

83 H 201  
83 HC 201

Part II: PHOTOGRAPHIC COMPARISONS

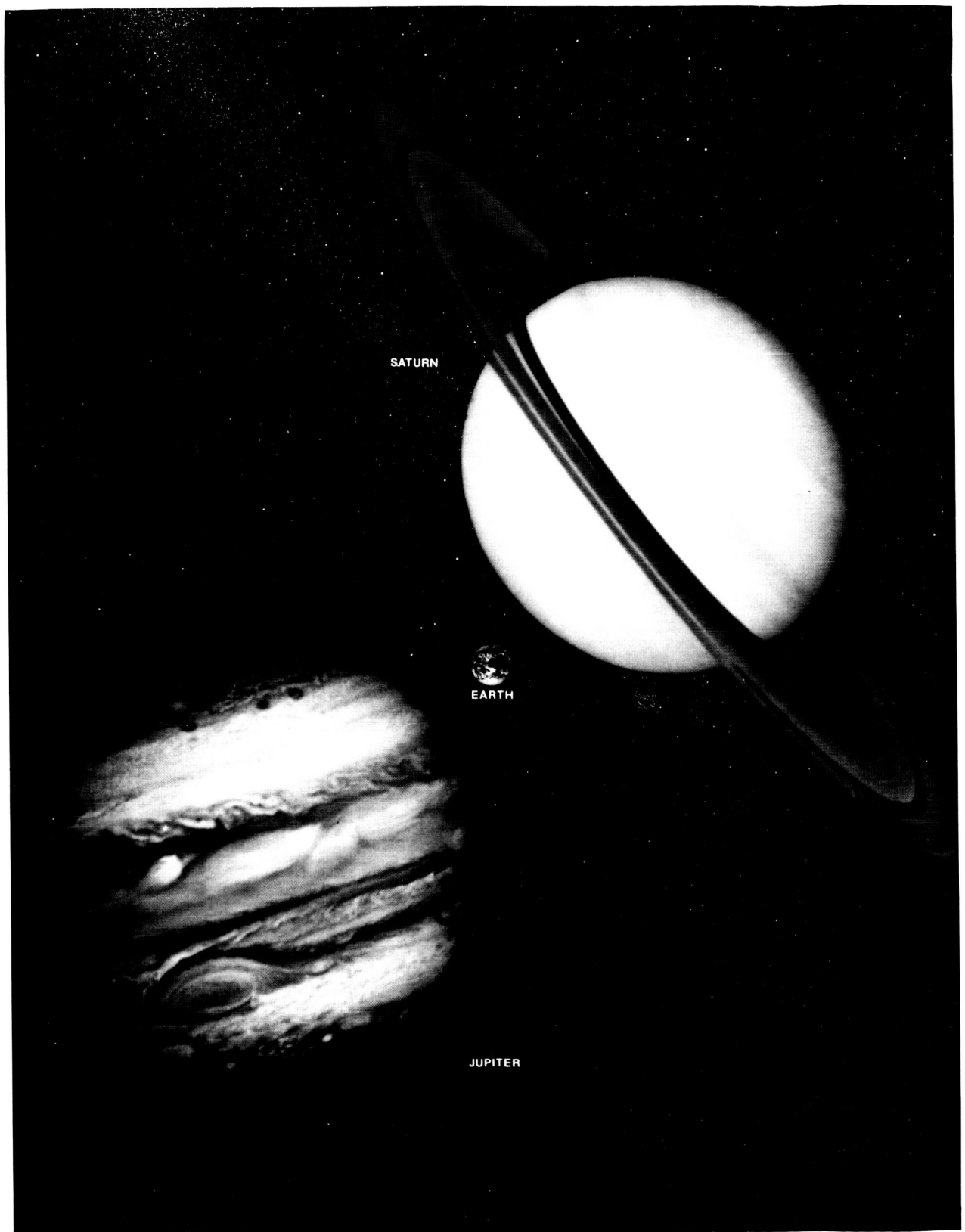


Photo 2 – GIANT PLANETS

83 H 202  
83 HC 202



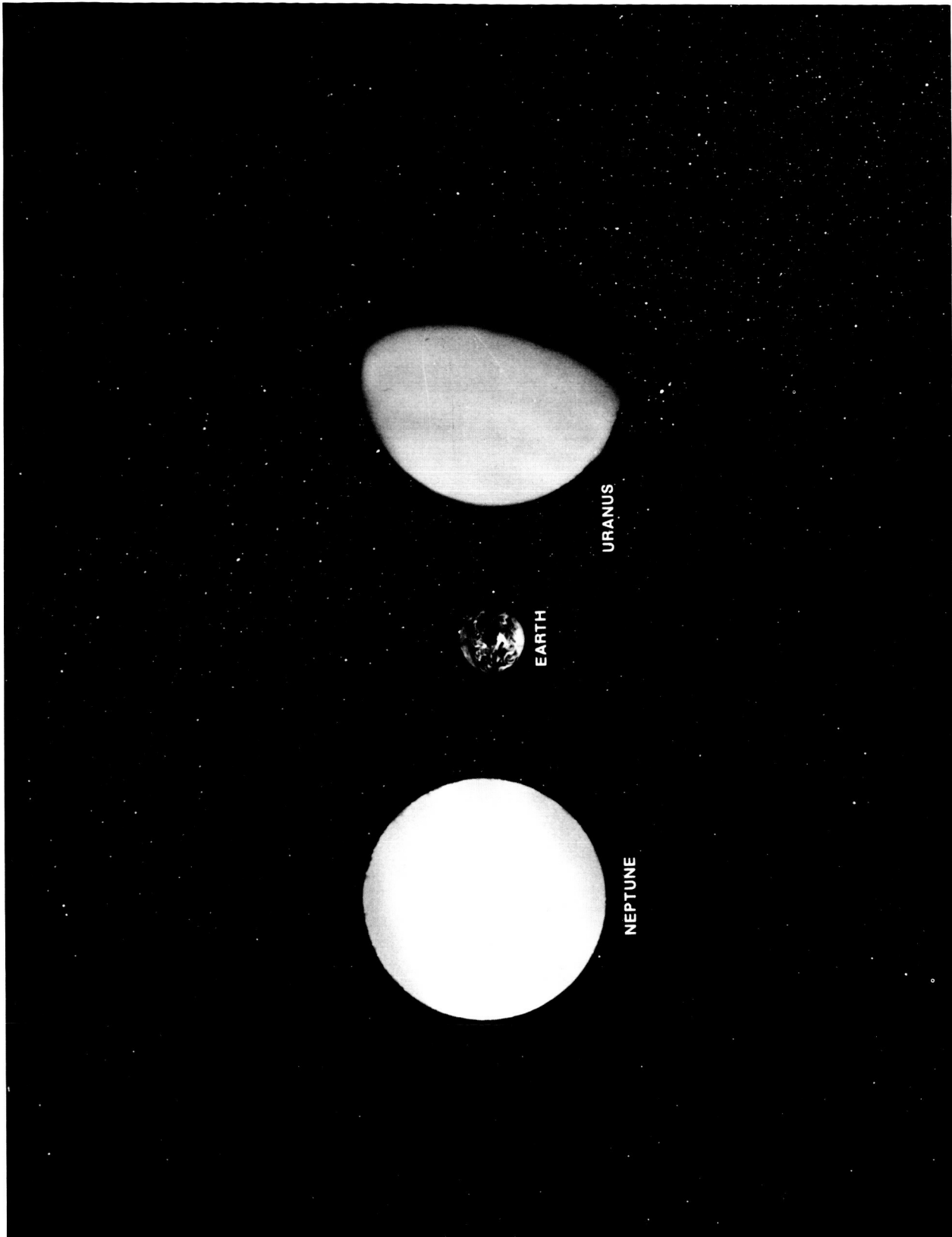


Photo 3 – LARGE PLANETS

83 H 203  
83 HC 203

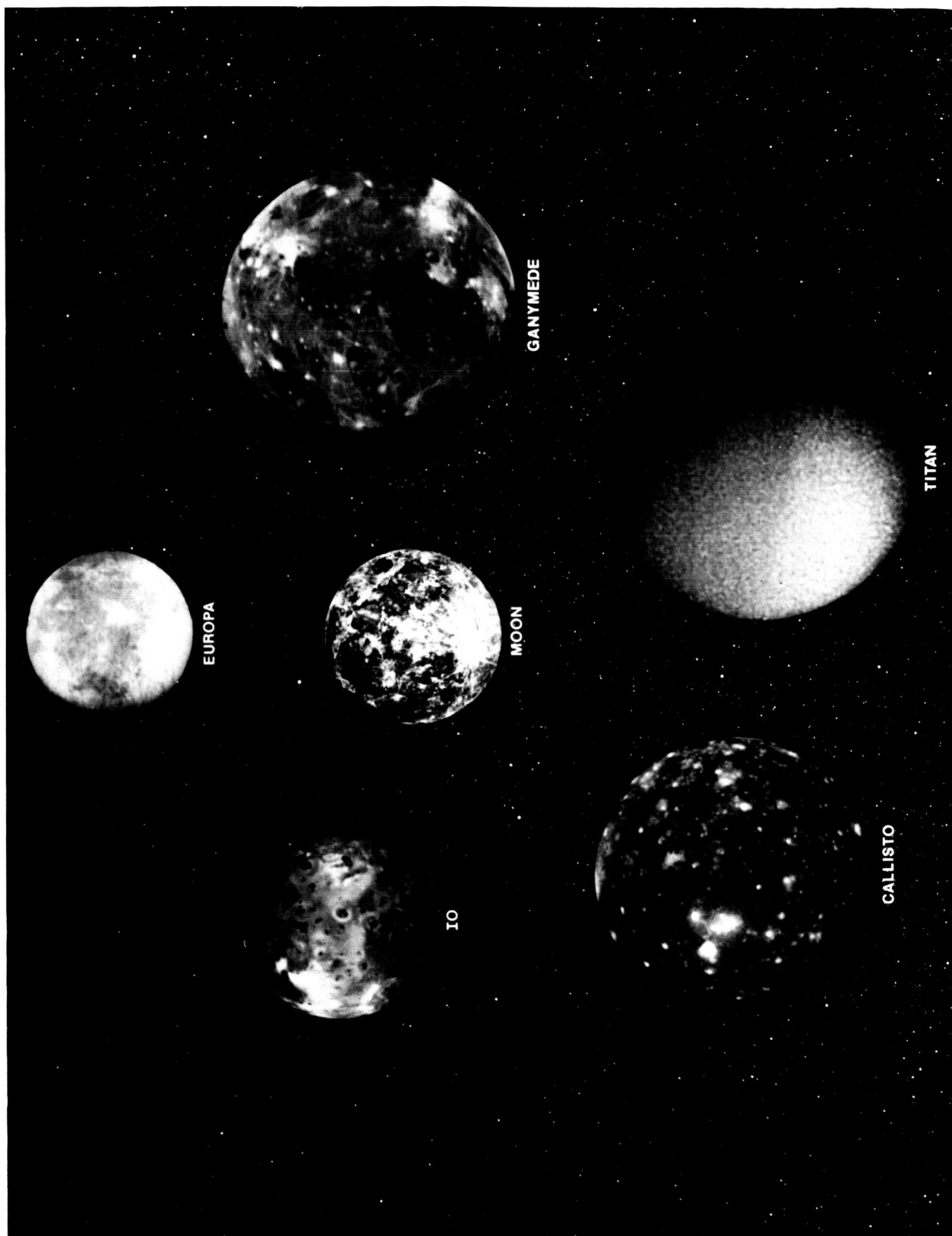


Photo 4 – LARGE MOONS

83 H 204  
83 HC 204

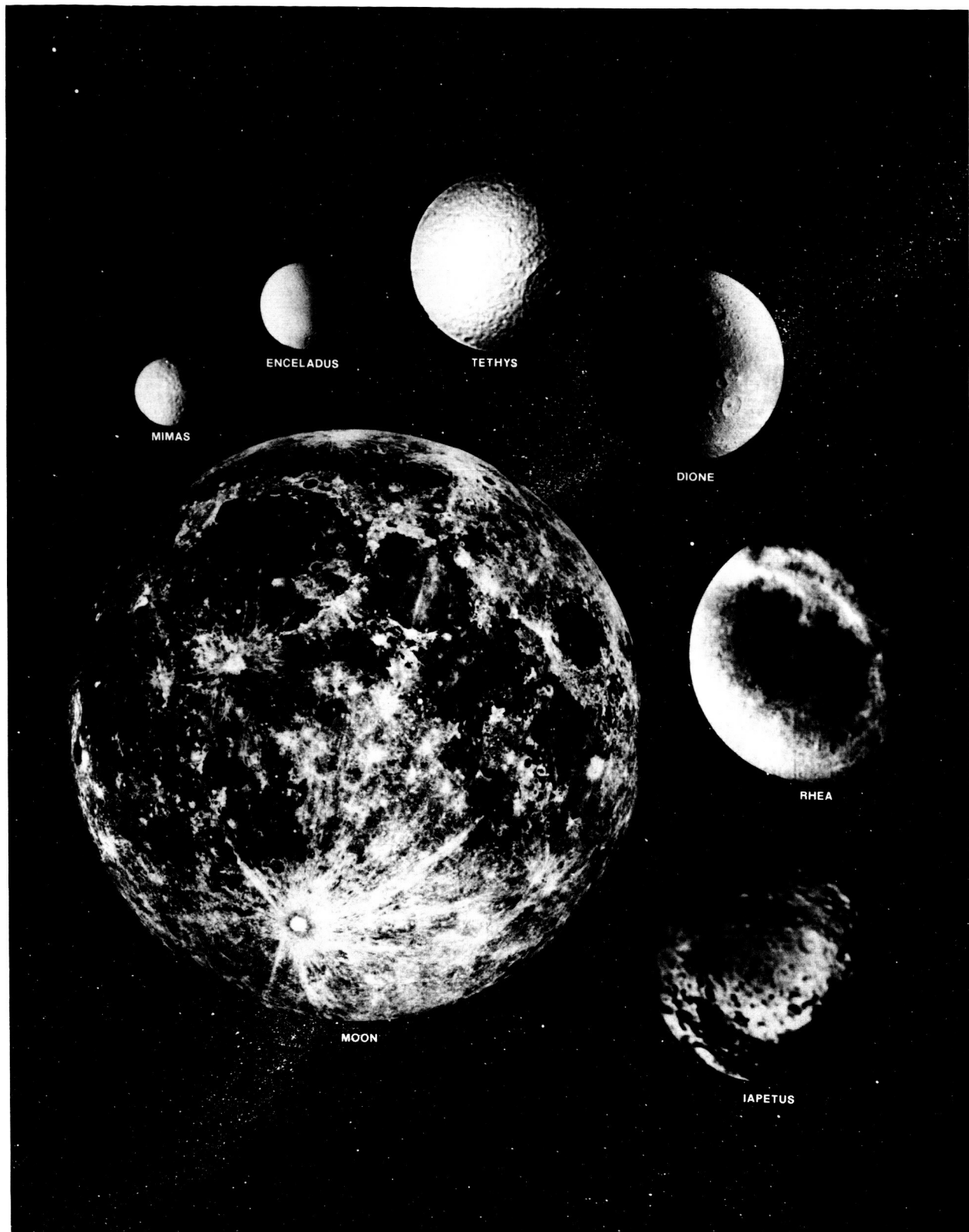


Photo 5 – MOONS OF SATURN

83 H 222

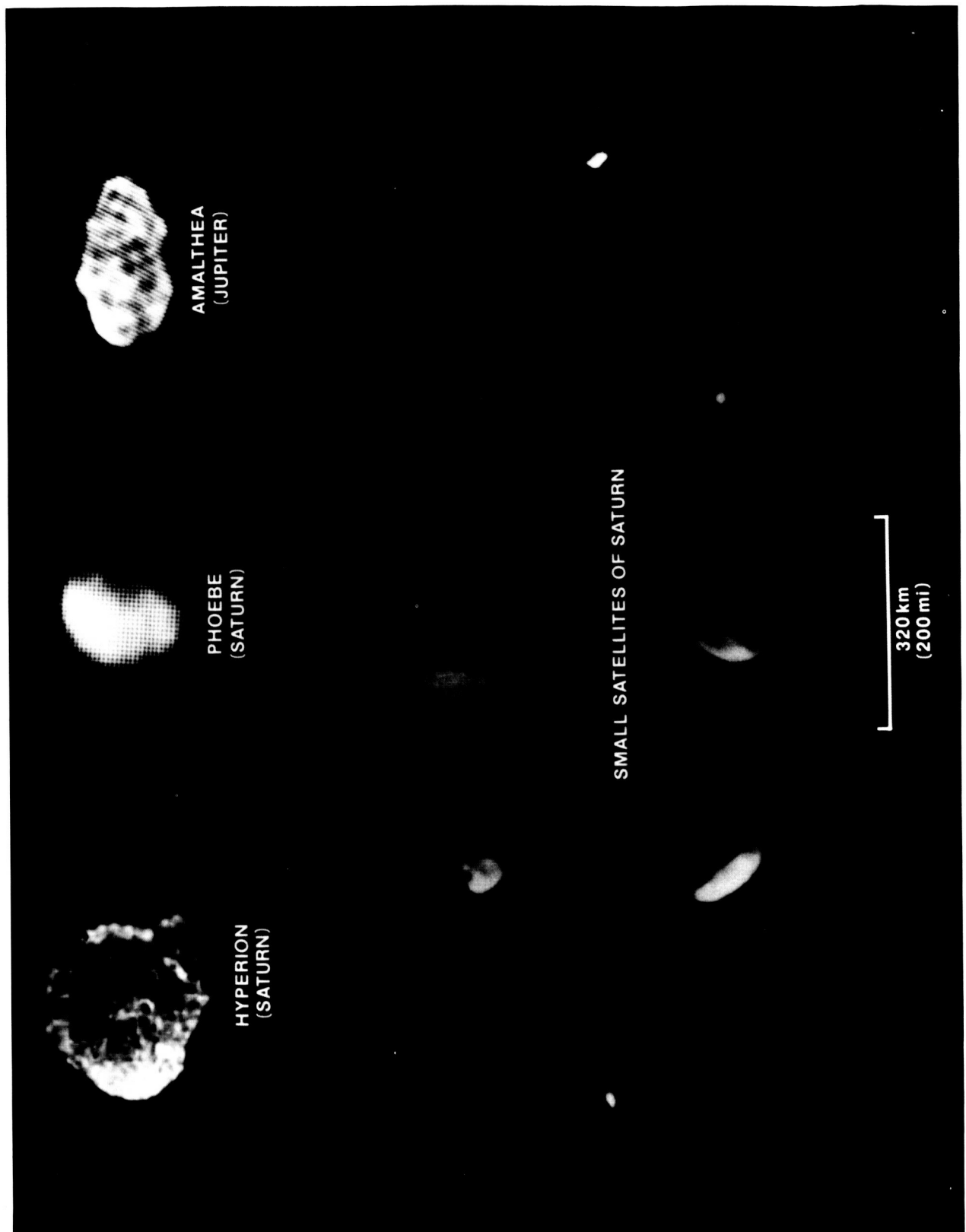


Photo 6 – SMALL MOONS

83 H 224

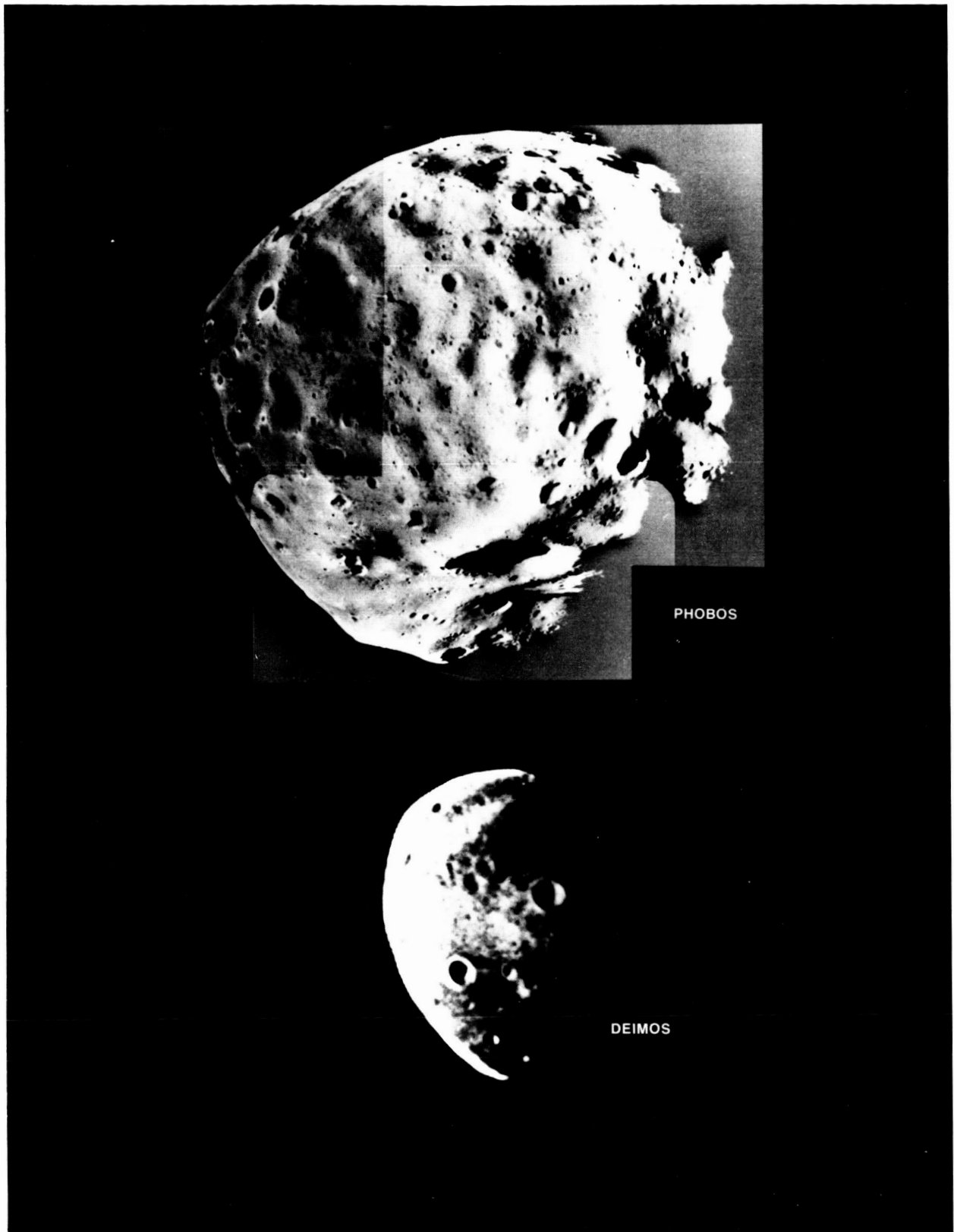


Photo 7 – THE MOONS OF MARS

83 H 225



Photo 8 – PLANETARY COMPARISONS #1

85 H 52  
85 HC 50

# GLOBAL PLANETARY COMPARISONS

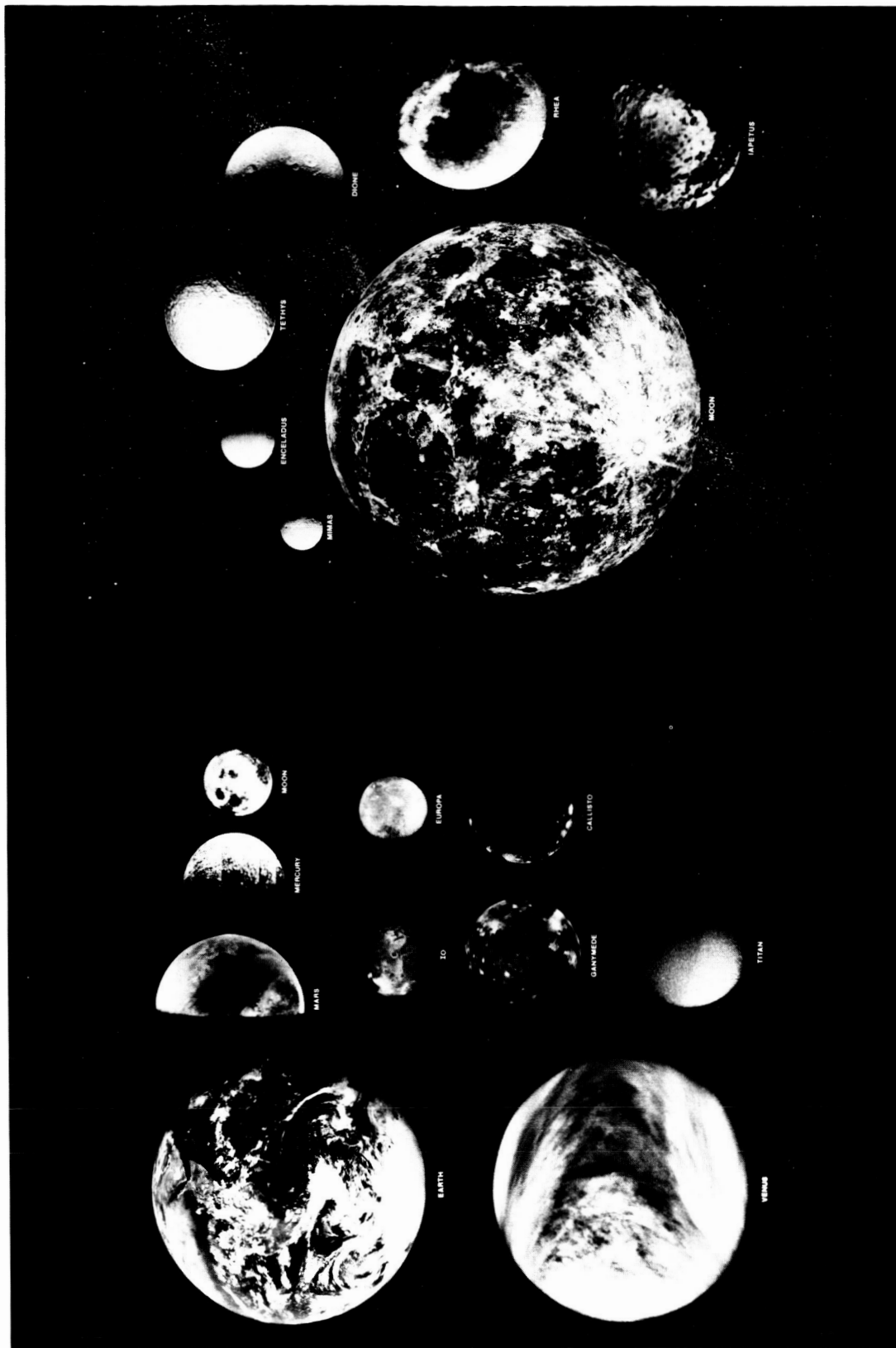


Photo 9 – PLANETARY COMPARISONS #2

85 H 53  
85 HC 51

Part II: PHOTOGRAPHIC COMPARISONS

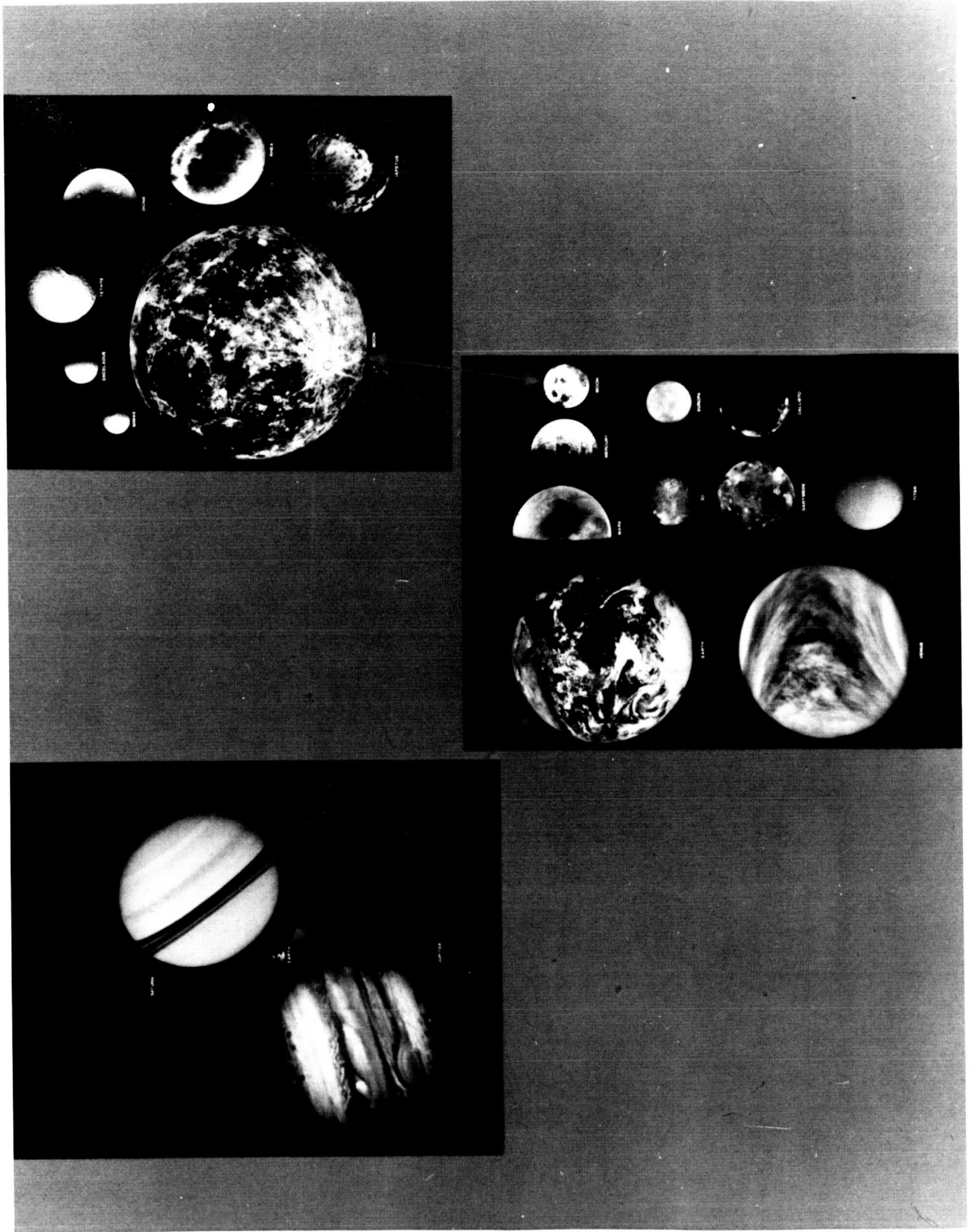


Photo 10 – PLANETARY COMPARISONS #3

85 H 54  
85 HC 52



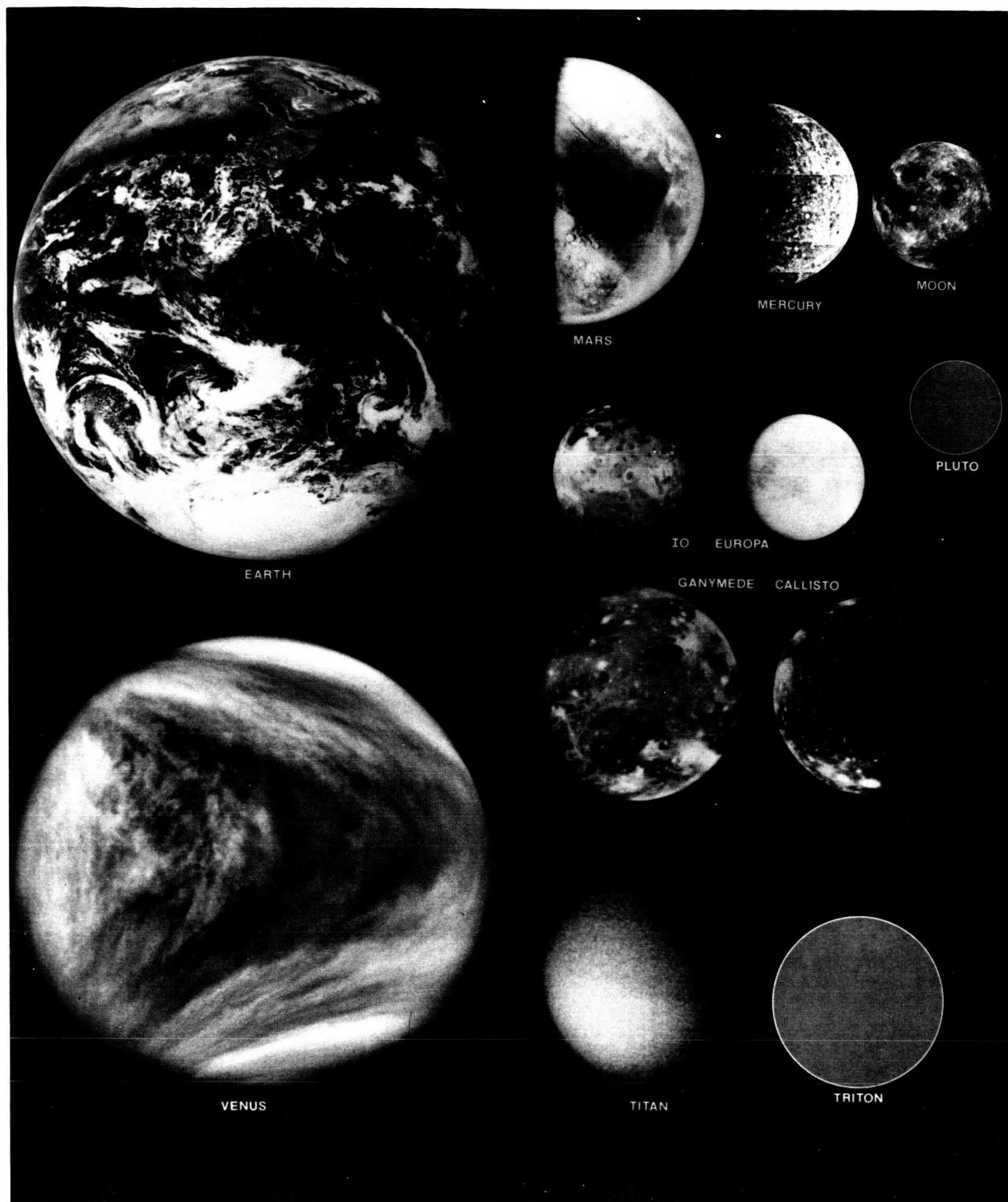


Photo 11 – MID-SIZED PLANETS AND LARGE MOONS

85 H 56



Photo 12 – FOUR LARGE PLANETS

85 H 55

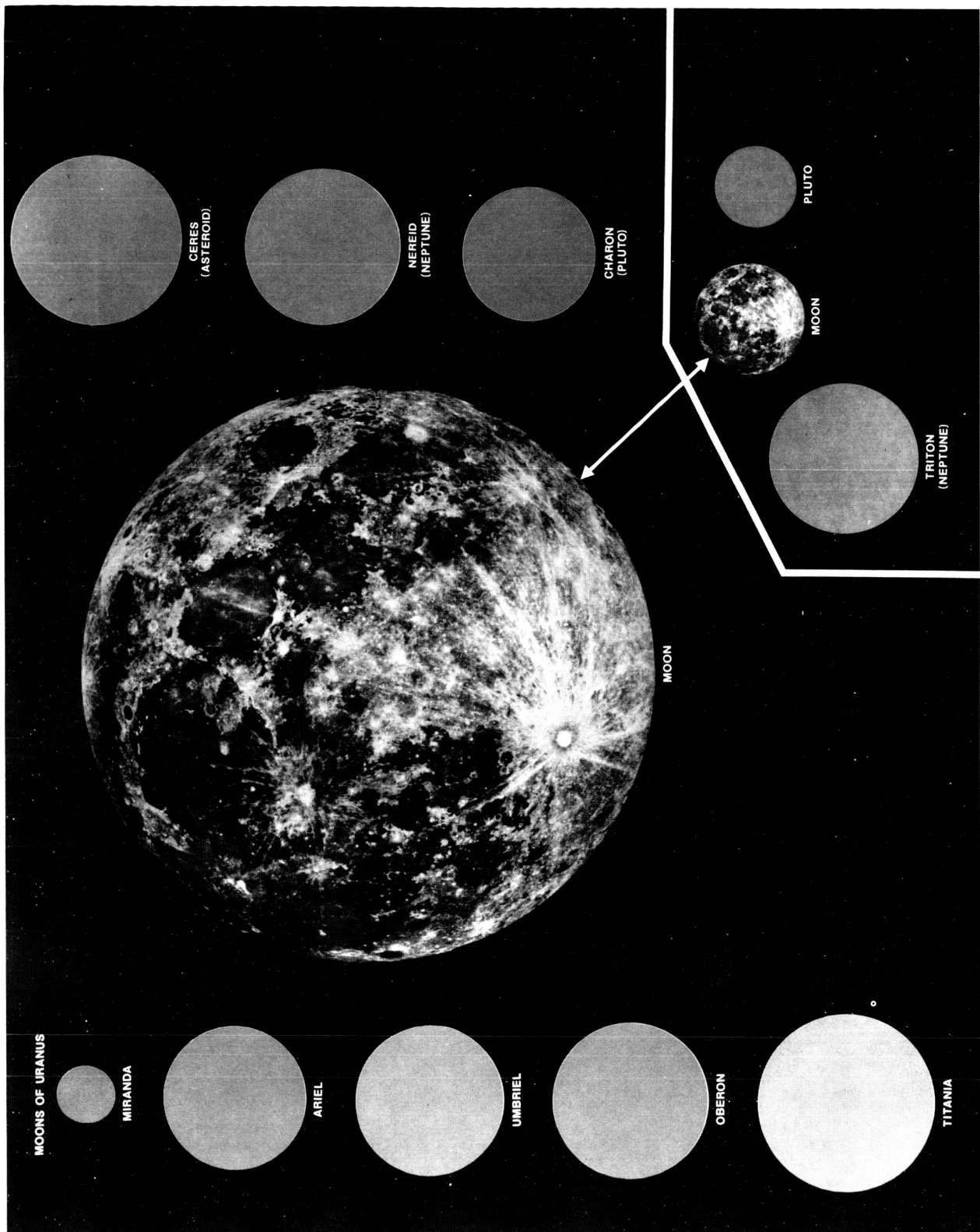


Photo 13 – OTHER DESTINATIONS

83 H 256

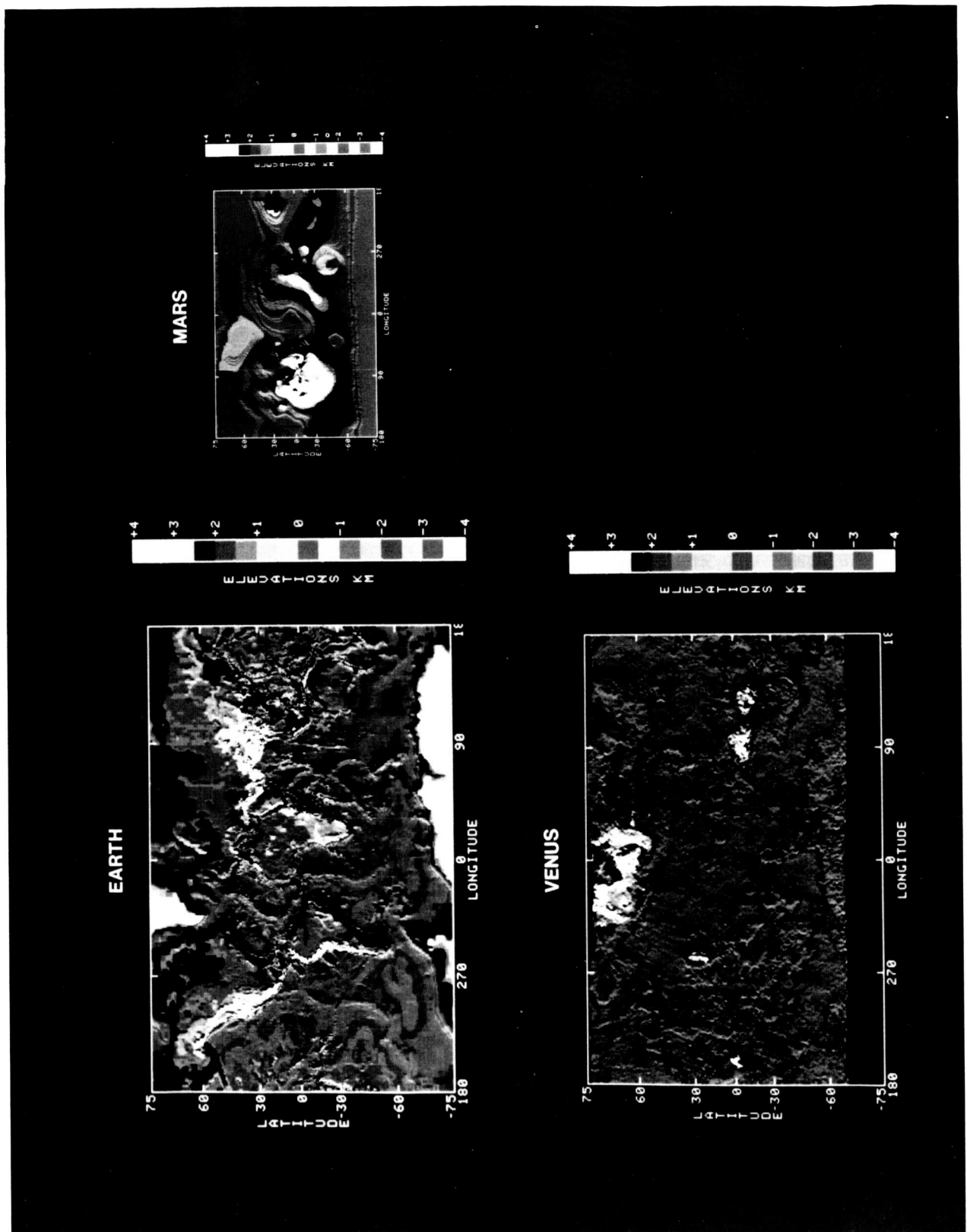


Photo 14 – RADAR VIEWS: EARTH, VENUS, MARS

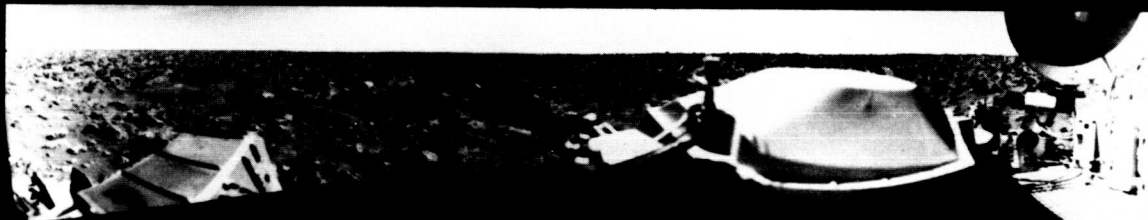
83 H 207  
83 HC 207

## MARS

VIKING 1

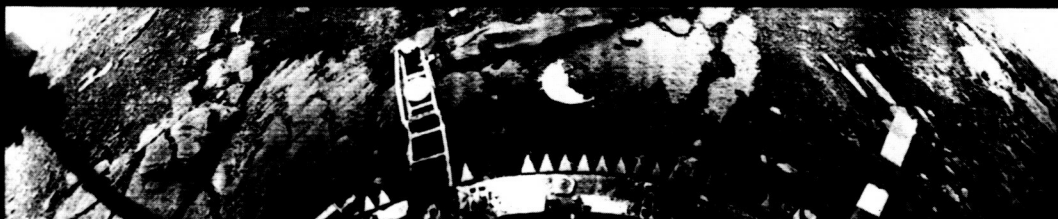


VIKING 2



## VENUS

VENERA 13



VENERA 14



Photo 15 – THE SURFACES OF MARS AND VENUS

83 H 255

# A COMPARISON OF CANYONS AND RIFT ZONES IN THE SOLAR SYSTEM

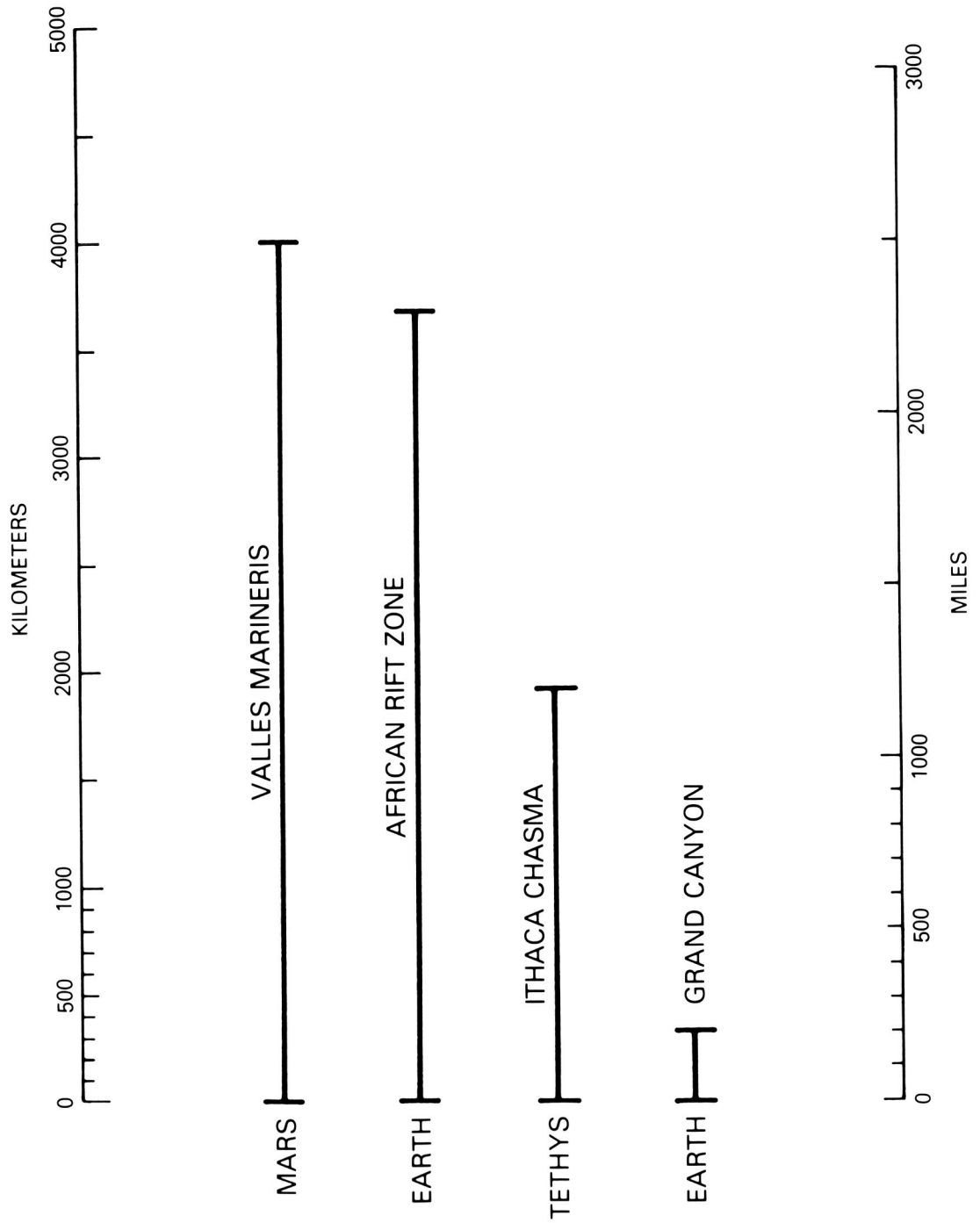
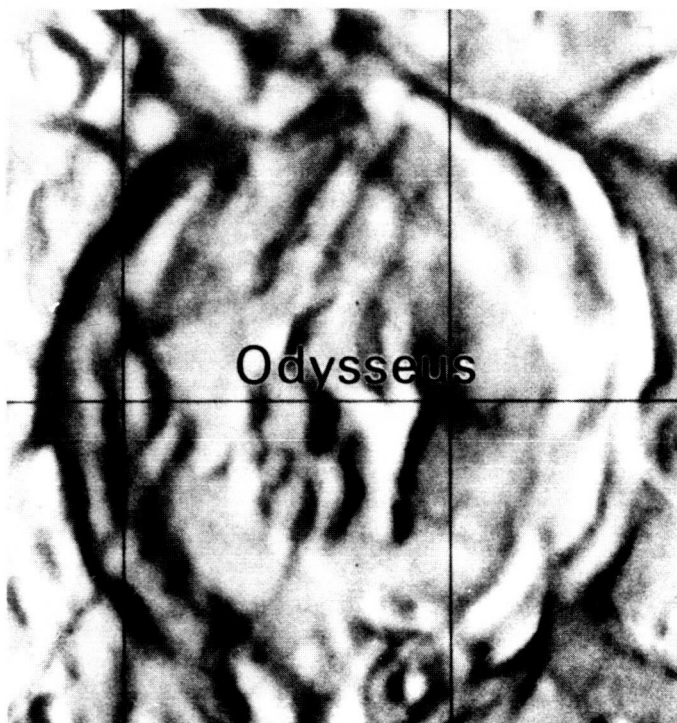


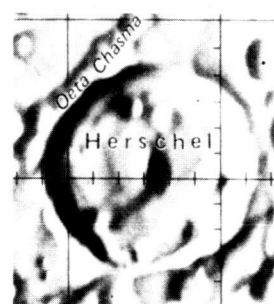
Photo 16 – TECTONIC FEATURE COMPARISONS

84 H 428

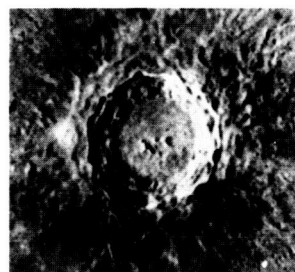
## CRATER COMPARISONS



ODYSSEUS  
(TETHYS)



HERSCHEL  
(MIMAS)



COPERNICUS  
(MOON)



CLAVIUS  
(MOON)

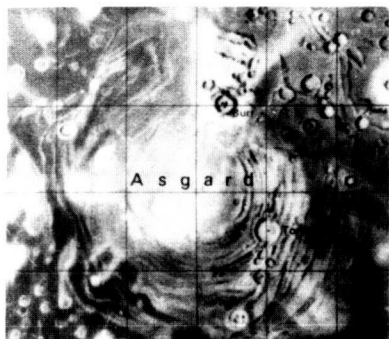


MANICOUAGAN  
(EARTH)

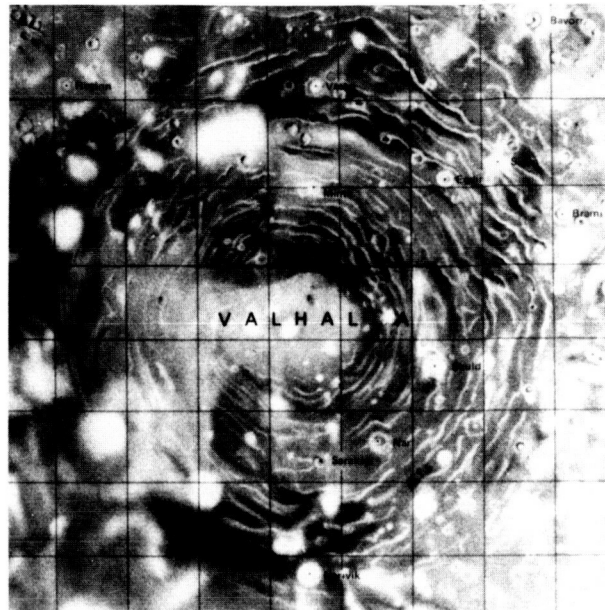
100 km



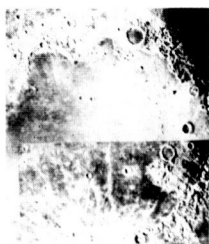
## IMPACT BASINS COMPARED



ASGARD  
(CALLISTO)



VALHALLA  
(CALLISTO)



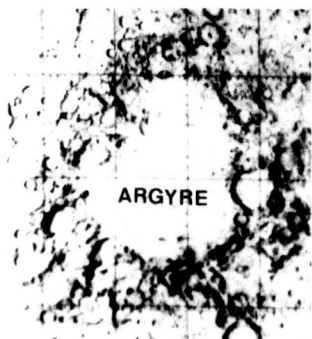
IMBRIUM  
(MOON)



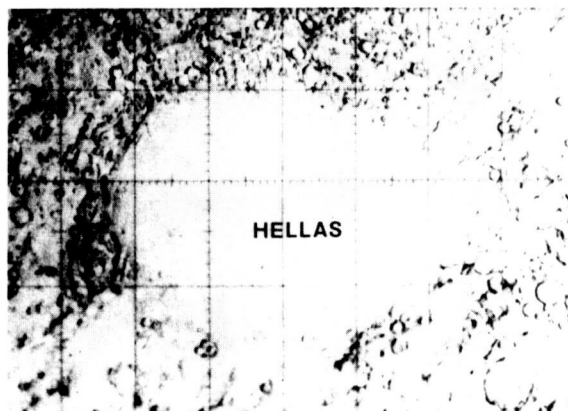
CALORIS  
(MERCURY)



ORIENTALE  
(MOON)



ARGYRE  
(MARS)



HELLAS  
(MARS)

1000 km



## VOLCANOES COMPARED

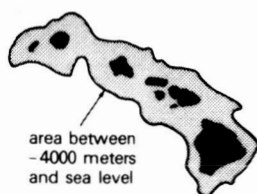


PELE  
(IO)



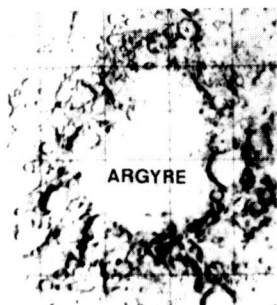
OLYMPUS MONS  
(MARS)

### HAWAIIAN ISLANDS

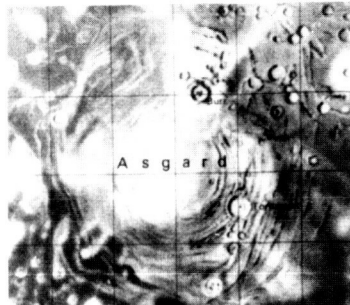


500 km

## OVERALL COMPARISONS



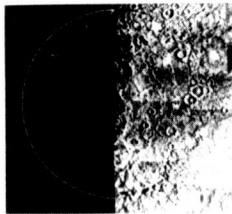
ARGYRE  
(MARS)



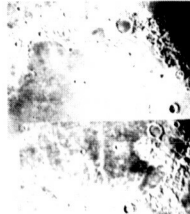
ASGARD  
(CALLISTO)



VALHALLA  
(CALLISTO)



CALORIS  
(MERCURY)



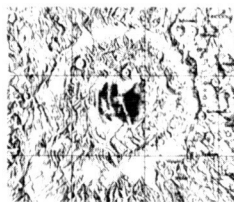
IMBRIUM  
(MOON)



PELE  
(IO)



OLYMPUS  
MONS  
(MARS)



ORIENTALE  
(MOON)

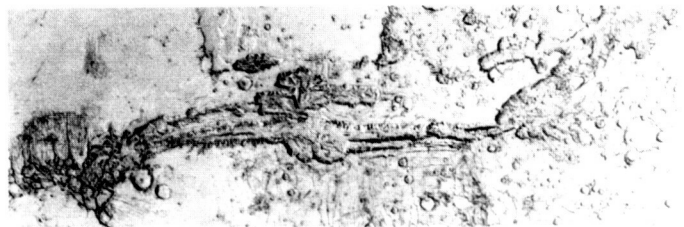


HELLAS  
(MARS)

1000 km



CASSINI REGIO  
(IAPETUS)



VALLES MARINERIS  
(MARS)

OVERALL COMPARISONS

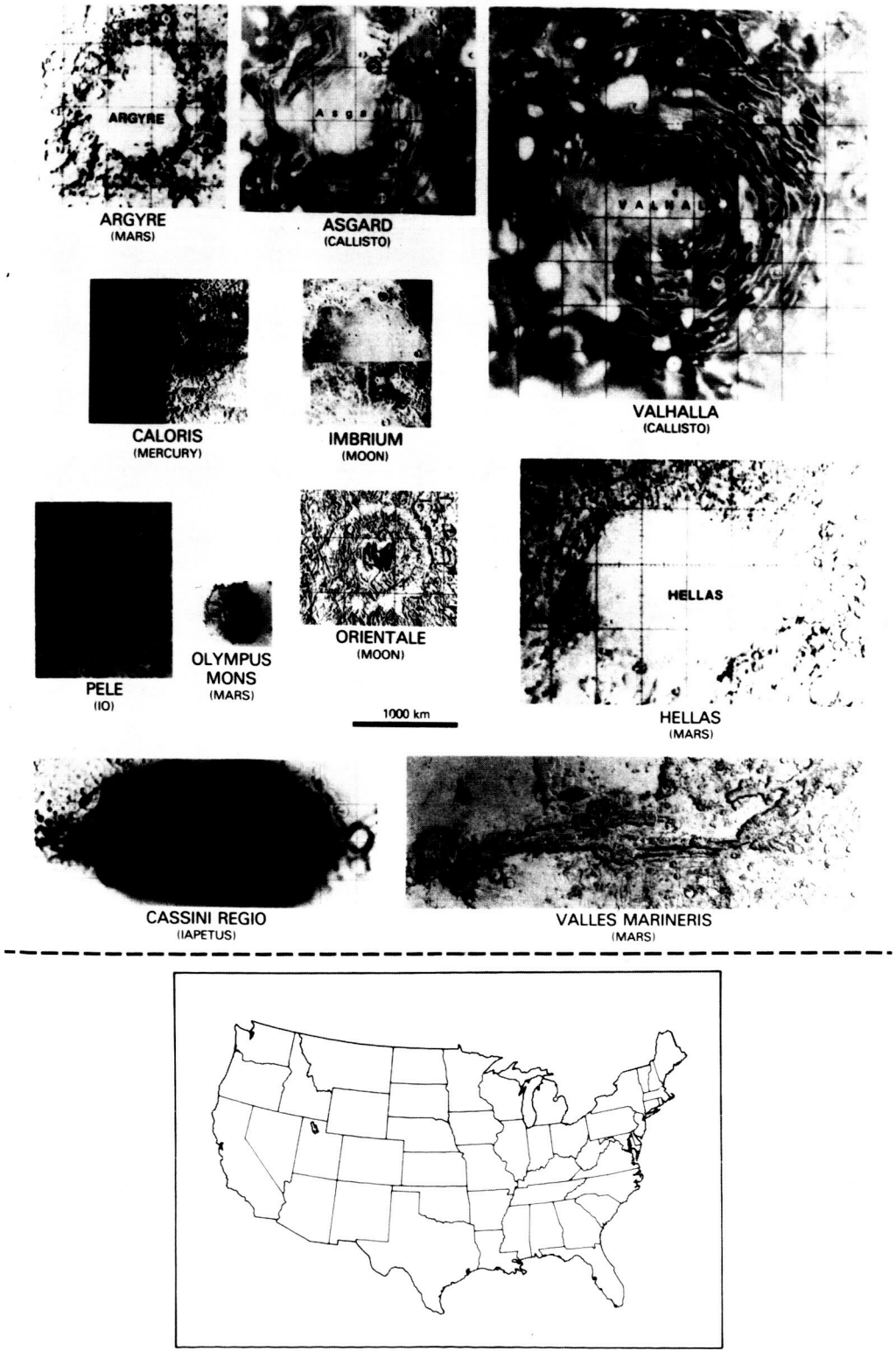


Photo 21 – OVERALL COMPARISONS (#2)

85 H 69



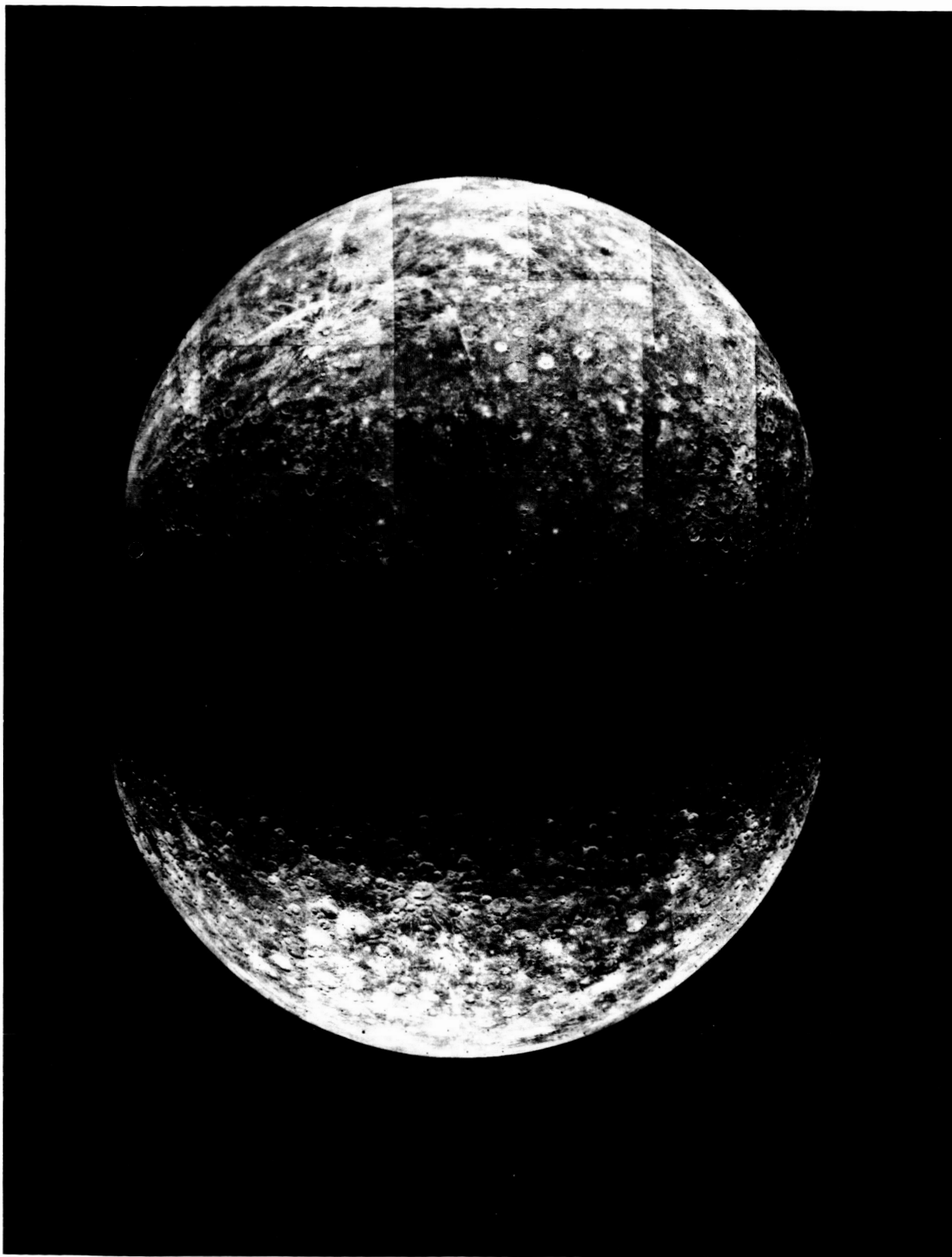


Photo 22 – MERCURY

83 H 260

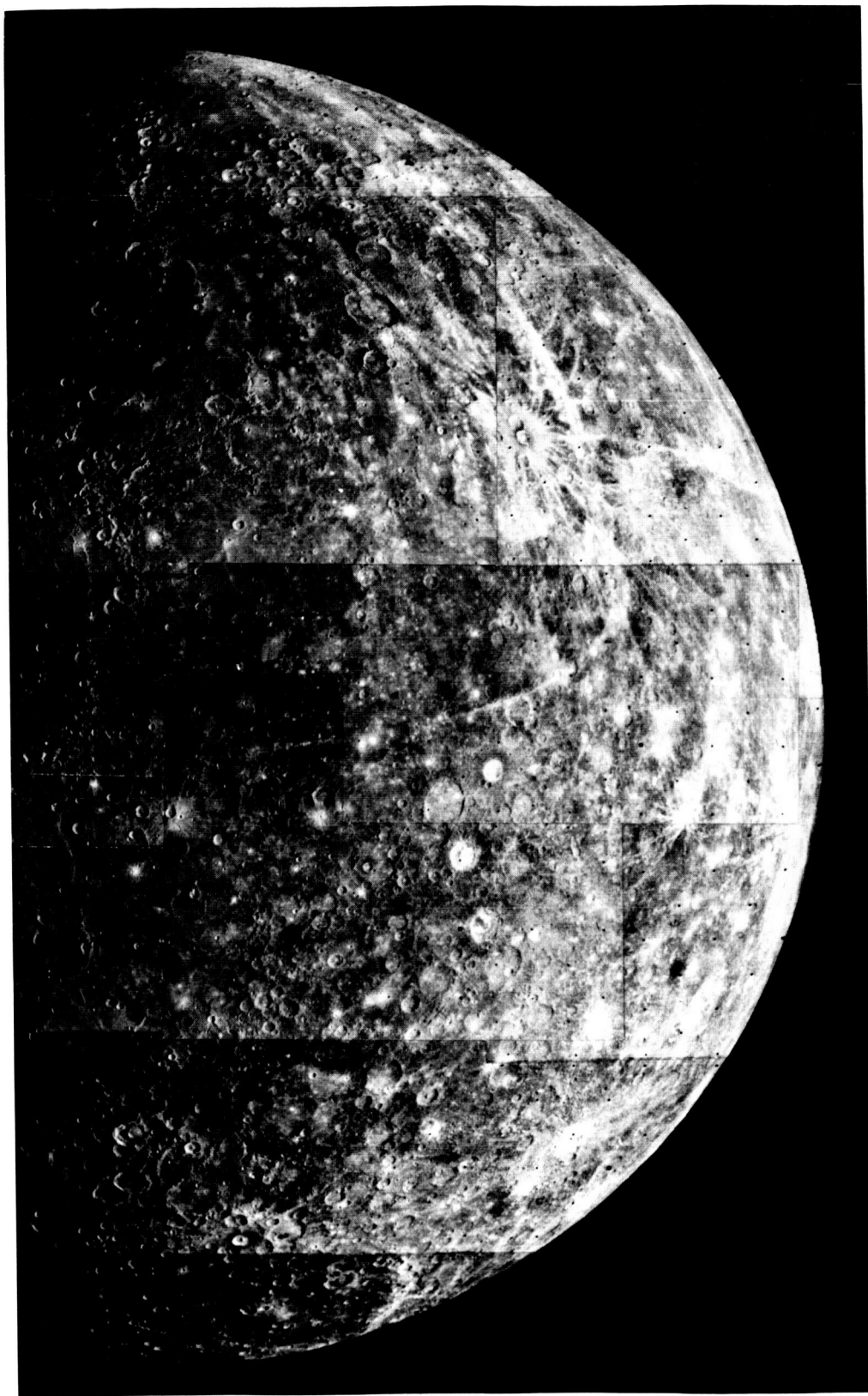


Photo 23 – MERCURY

74 H 253  
85 HC 48

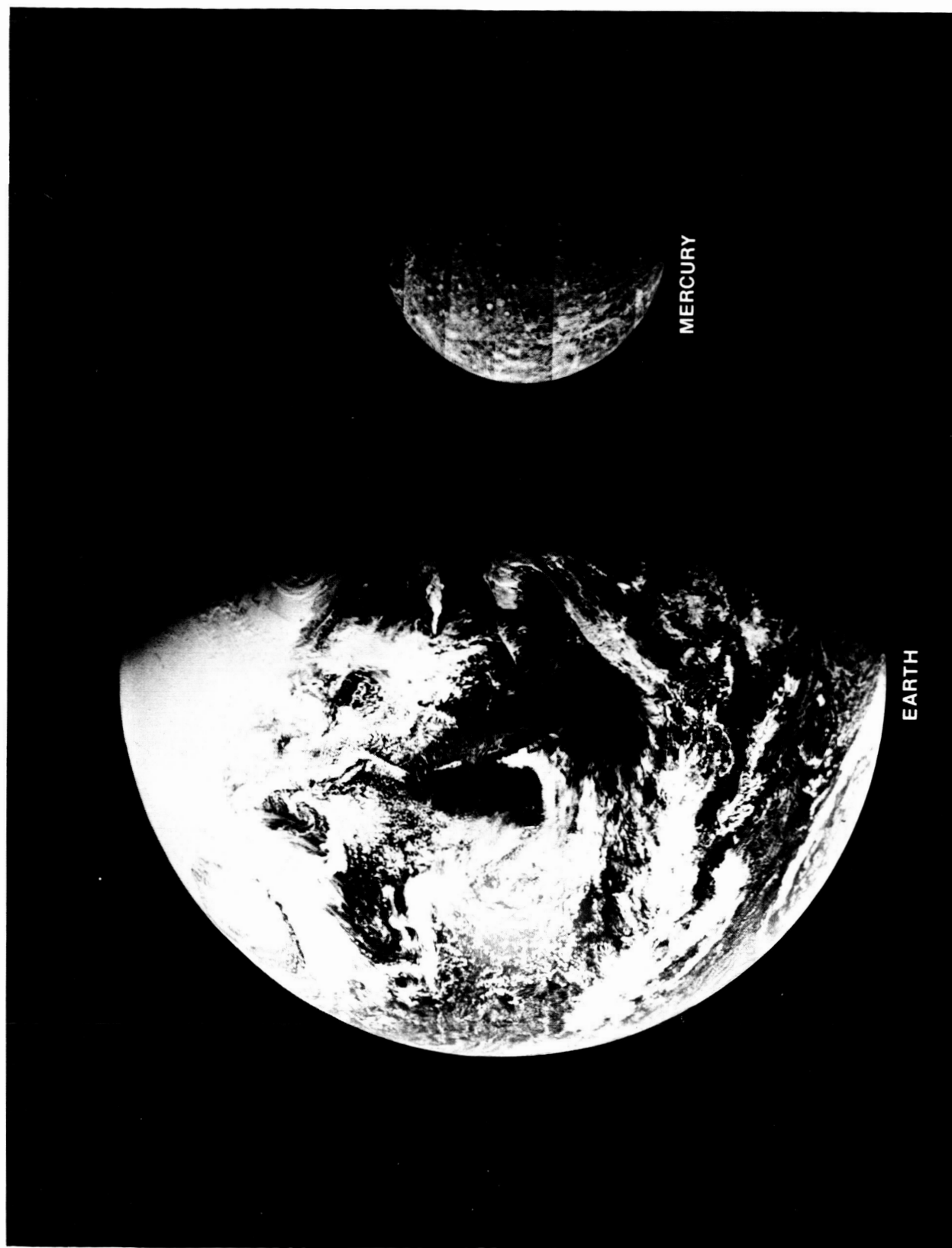


Photo 24 – MERCURY AND EARTH

83 H 227

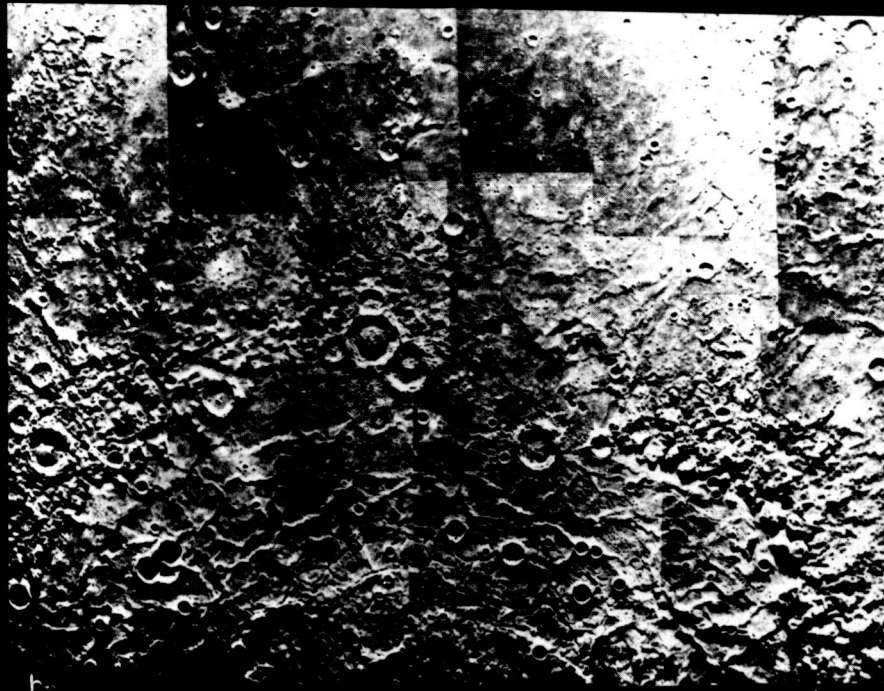


Photo 25 – THE CALORIS BASIN (#1)

84 H 420



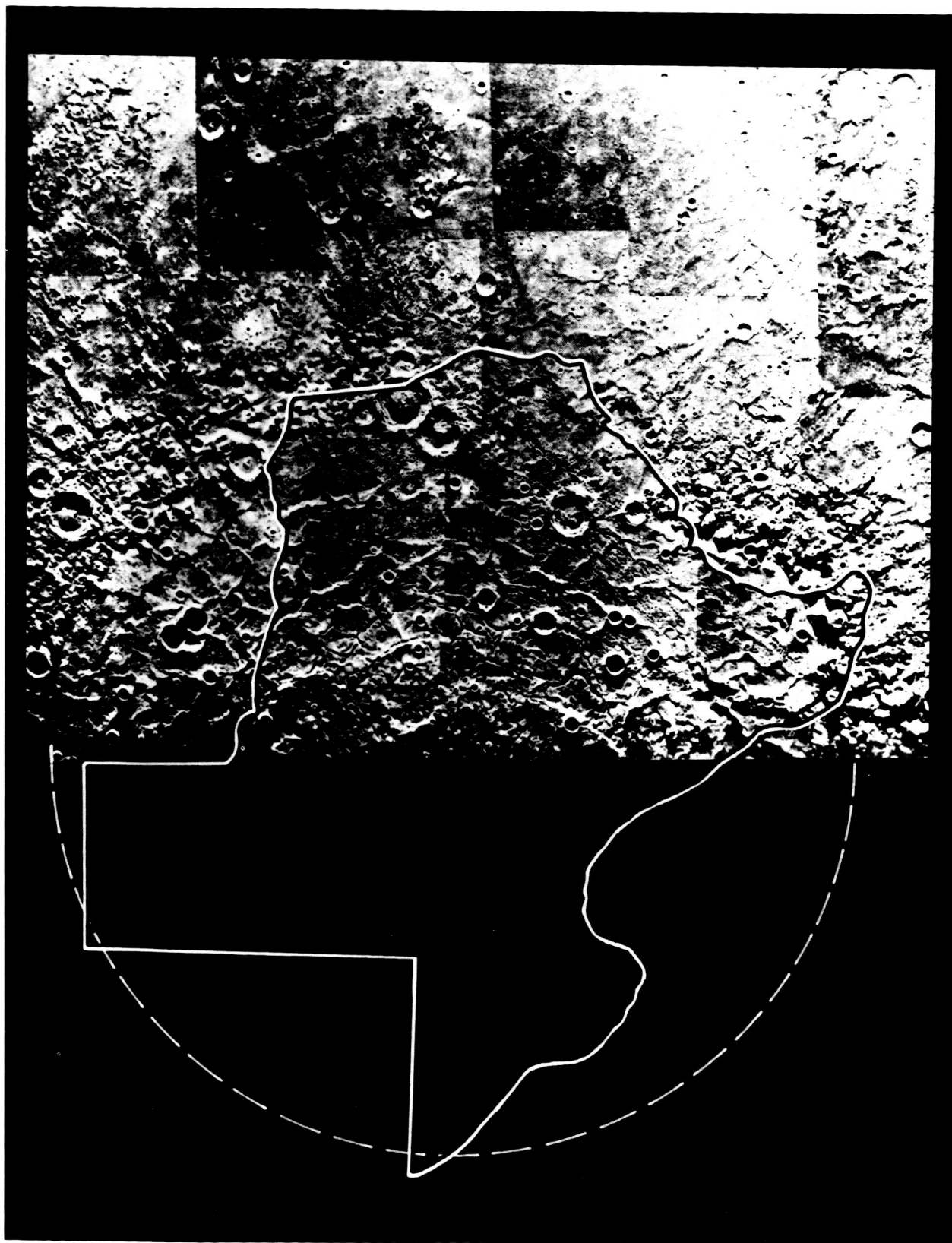


Photo 26 – THE CALORIS BASIN (#2)

83 H 241



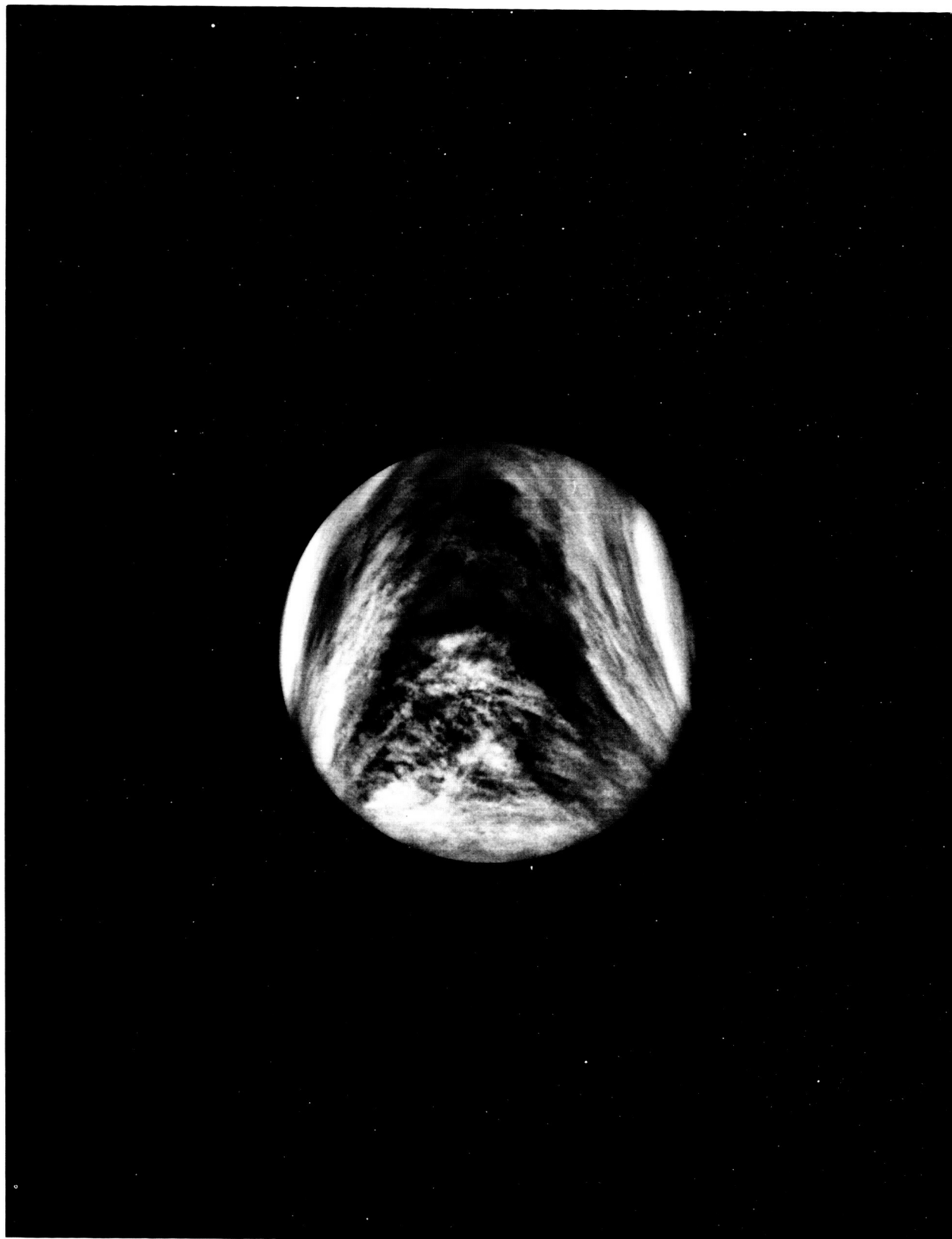


Photo 27 – VENUS

83 H 212  
83 HC 212

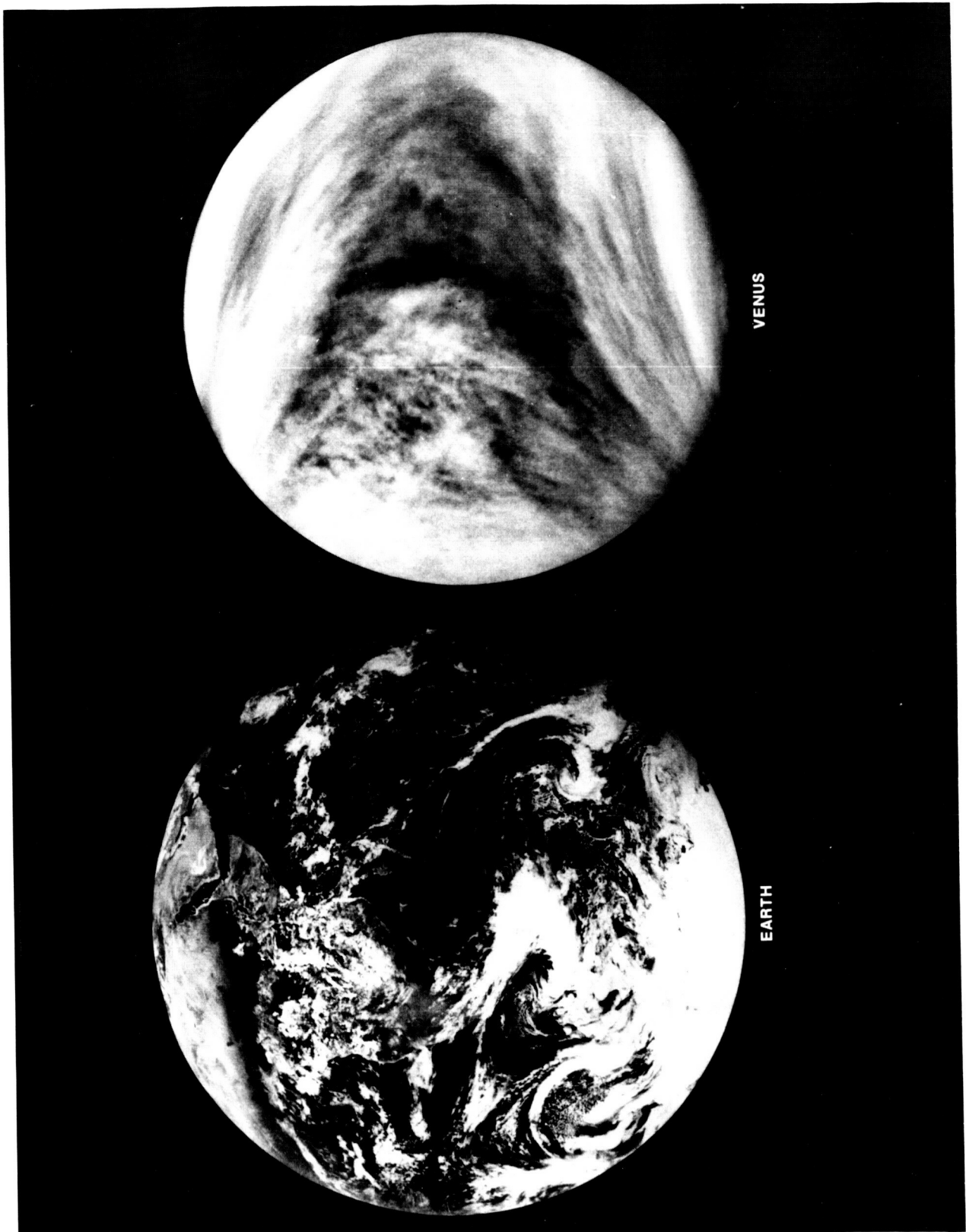


Photo 28 – VENUS AND EARTH

83 H 228

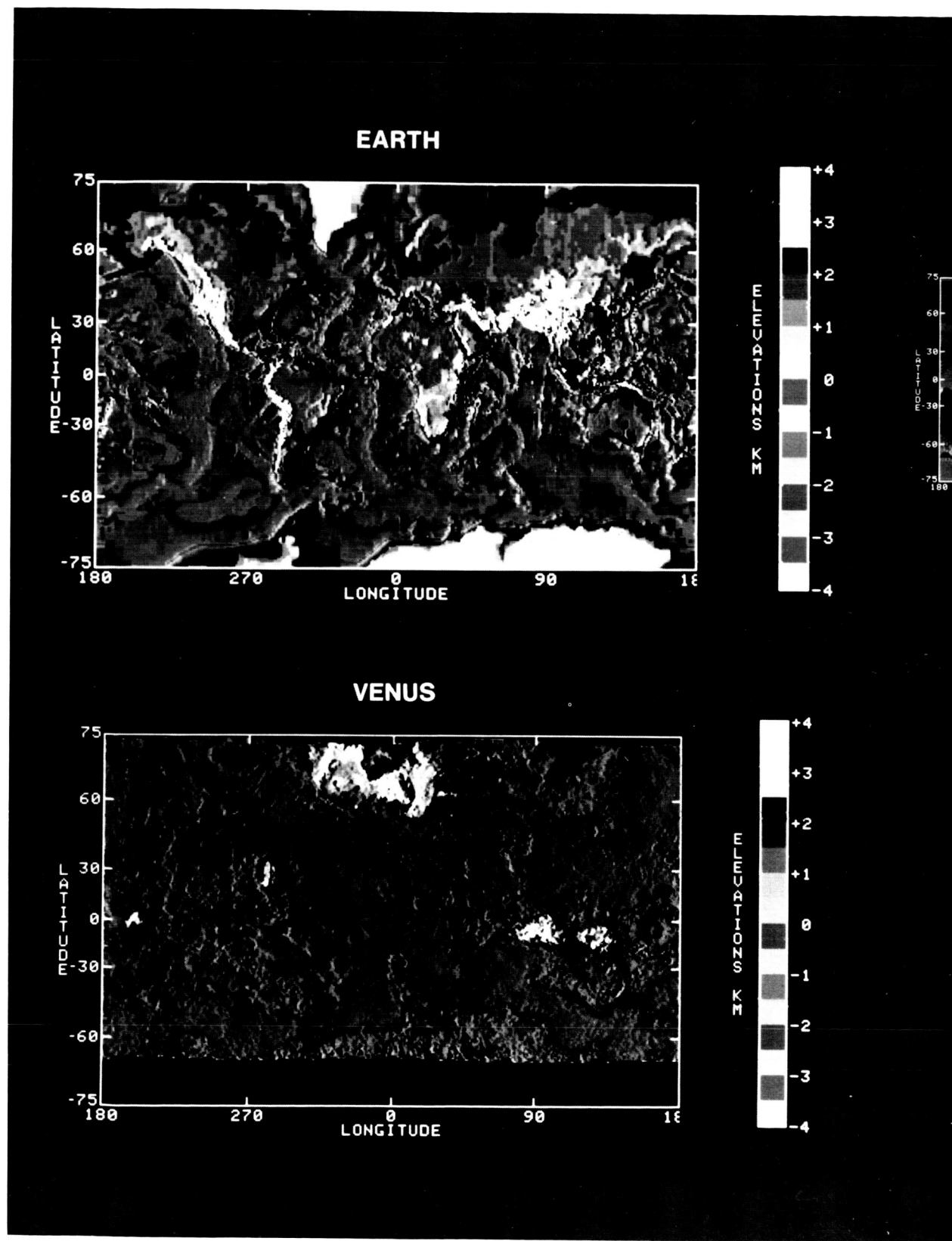
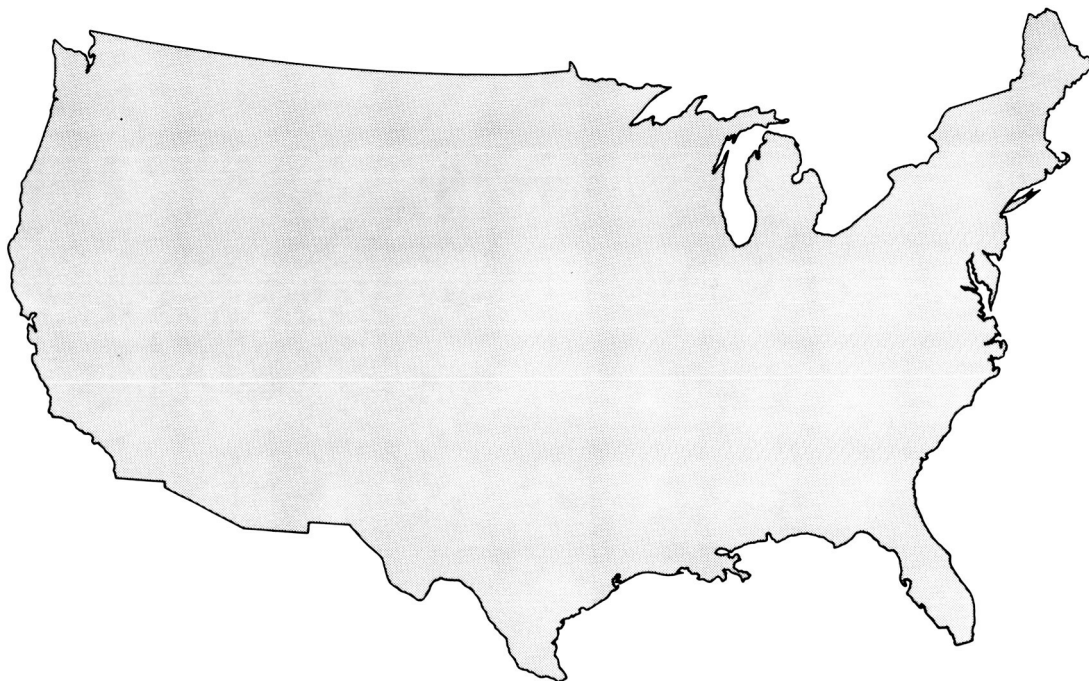


Photo 29 – RADAR VIEWS: EARTH AND VENUS

83 H 206  
83 HC 206

## UNITED STATES



## ISHTAR TERRA (VENUS)

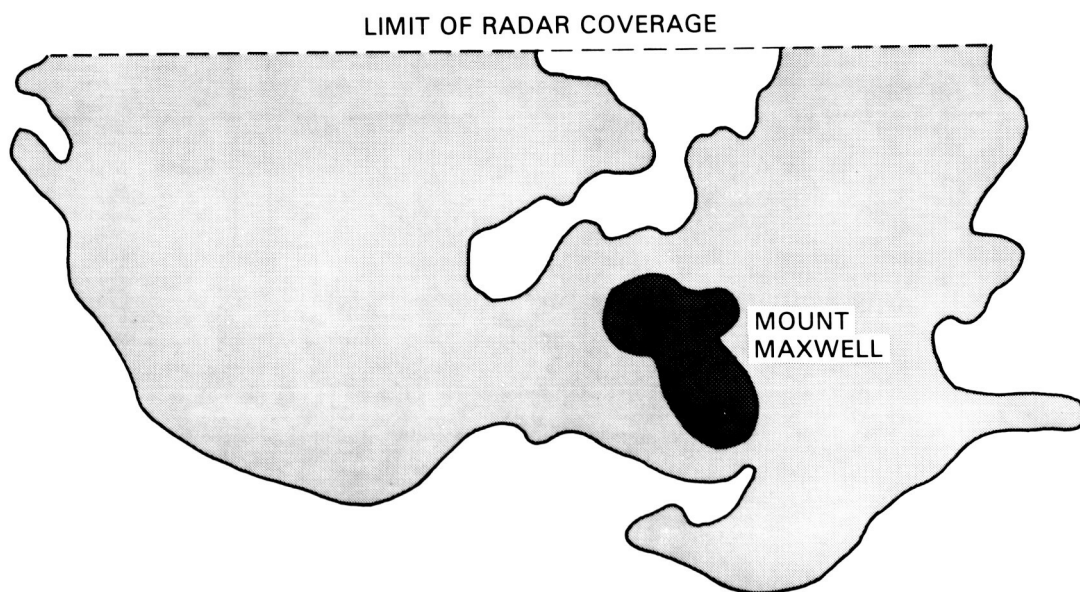


Photo 30 – ISHTAR TERRA

83 H 242

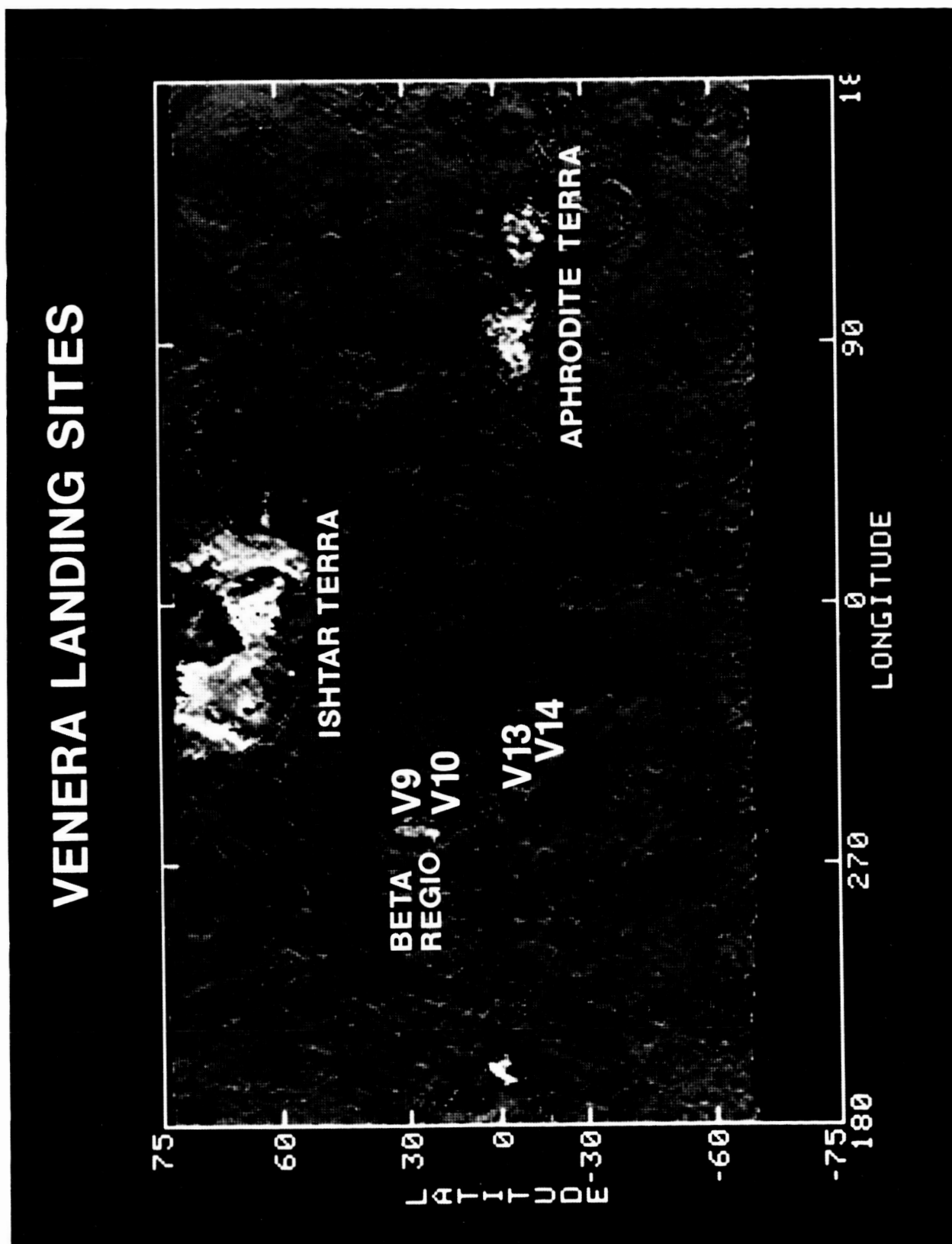


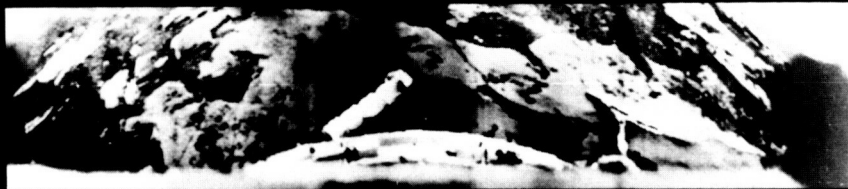
Photo 31 - VENERA LANDING SITES

83 H 259

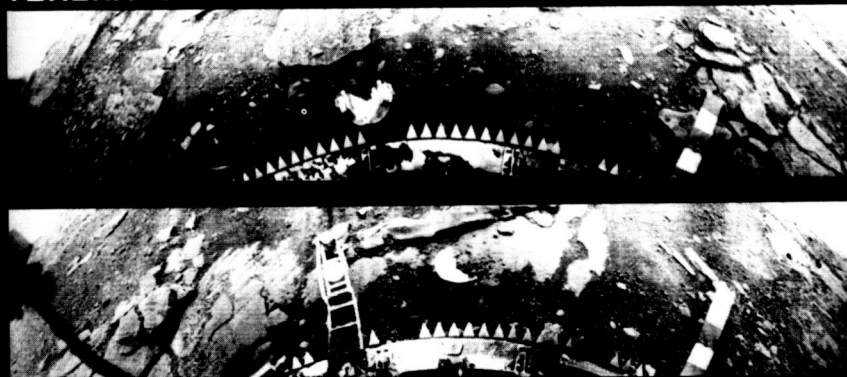
**VENERA 9**



**VENERA 10**



**VENERA 13**



**VENERA 14**

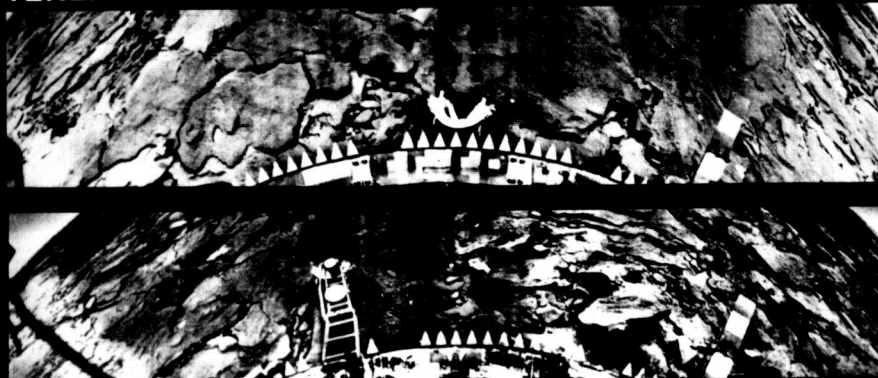


Photo 32 – THE SURFACE OF VENUS

83 H 254



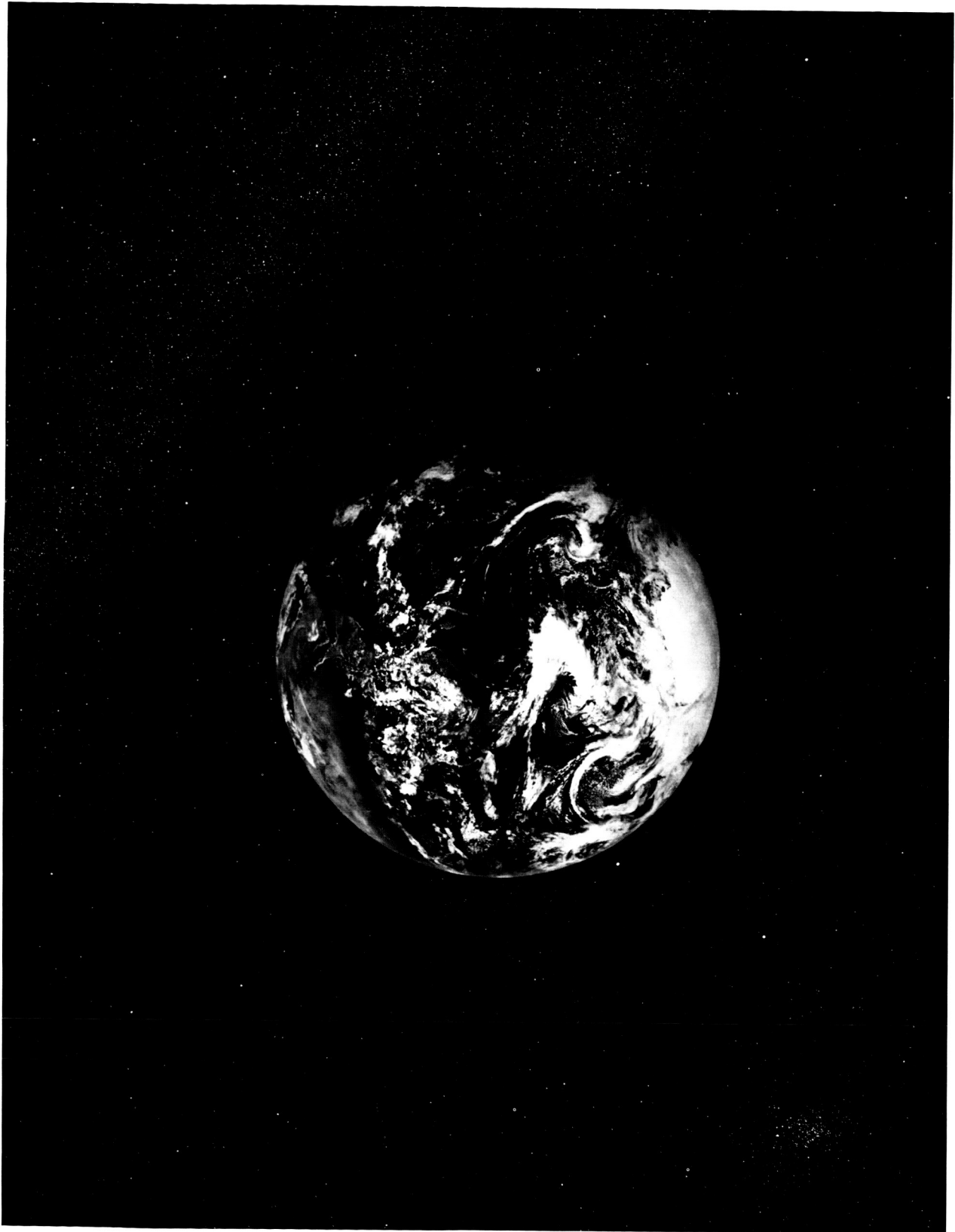


Photo 33 – EARTH

83 H 213  
83 HC 213

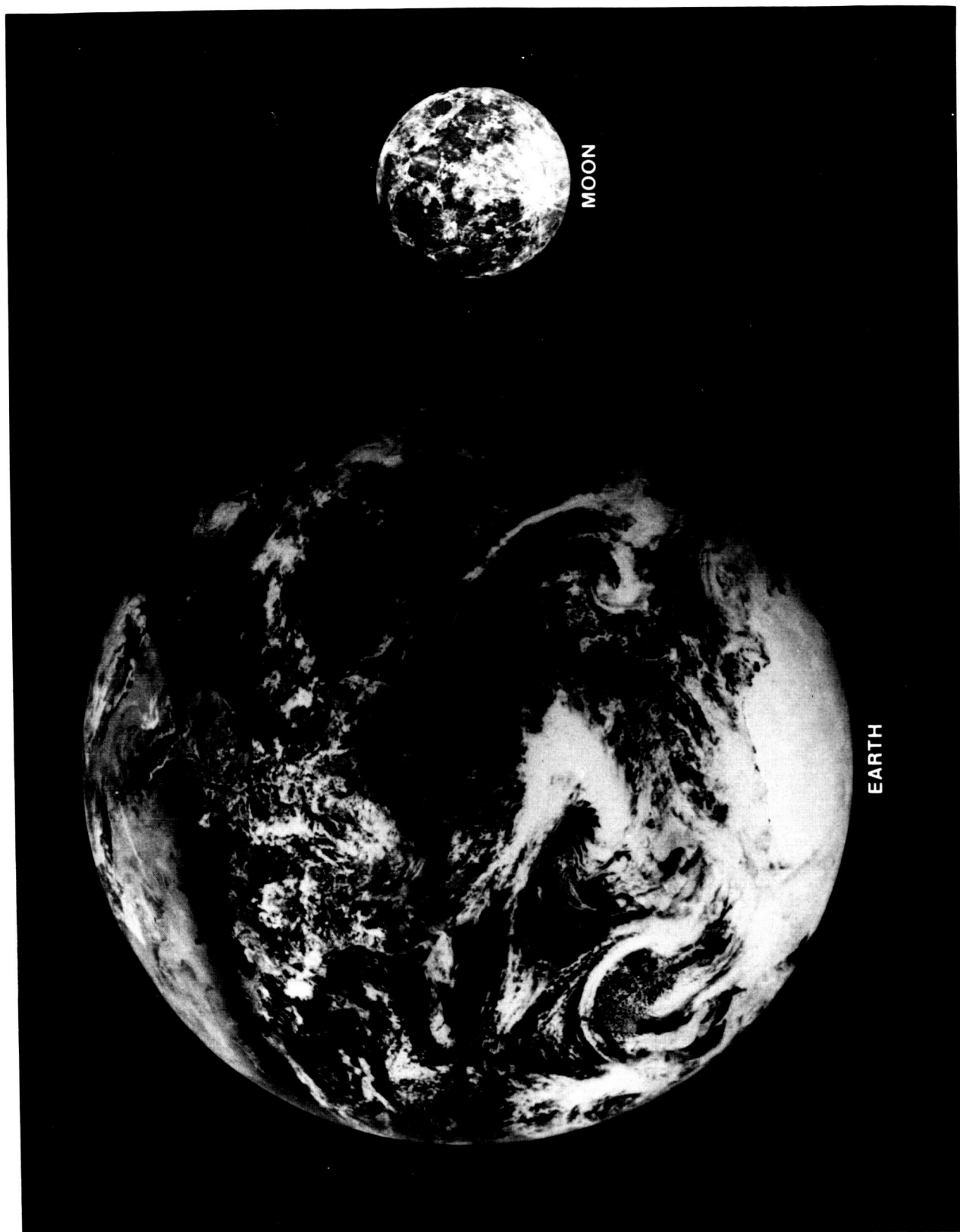


Photo 34 – EARTH AND MOON

83 H 229



Photo 35 – EARTHRISE

85 H 51  
85 HC 49

## APOLLO LANDING SITES

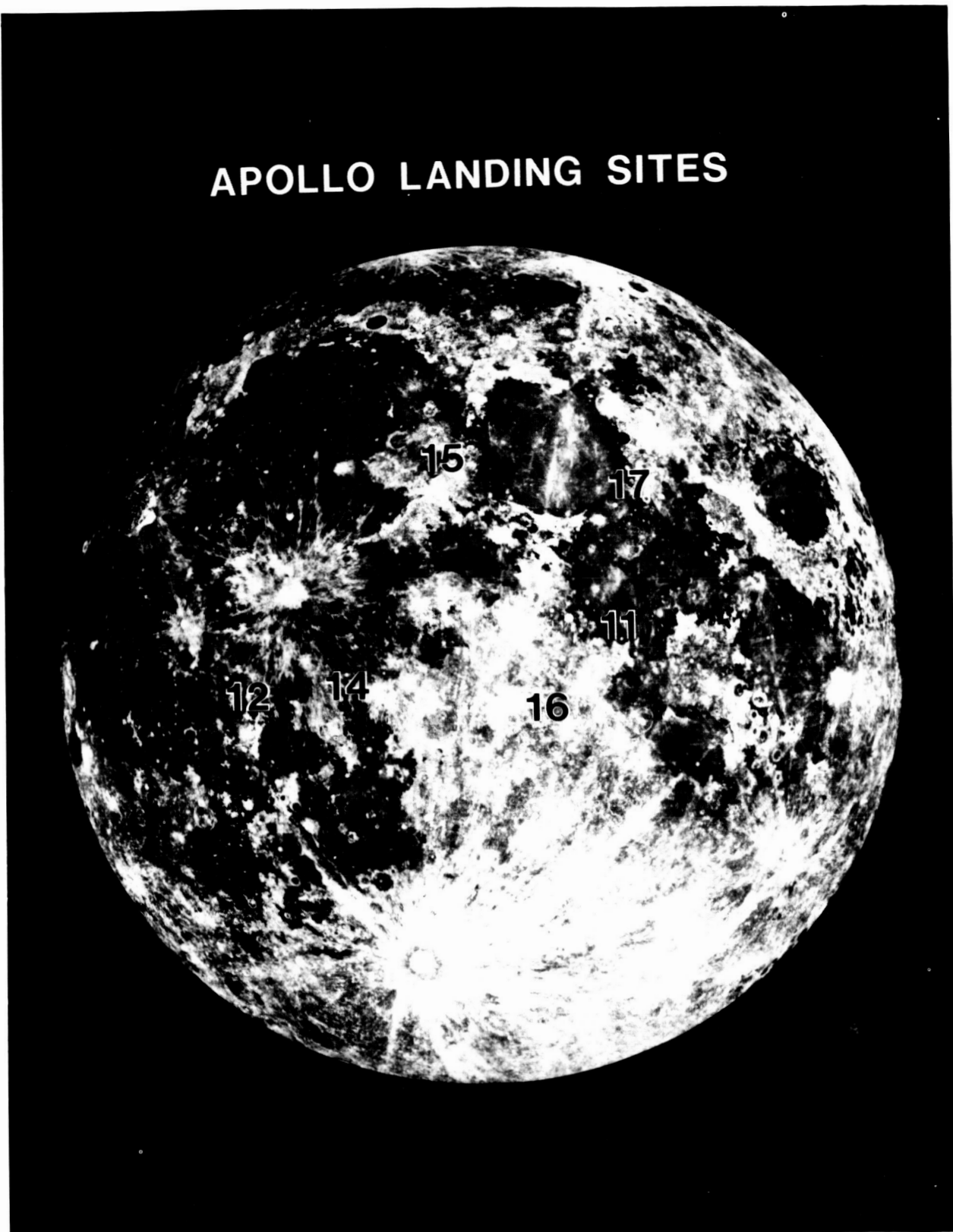


Photo 36 – APOLLO LANDING SITES

83 H 257

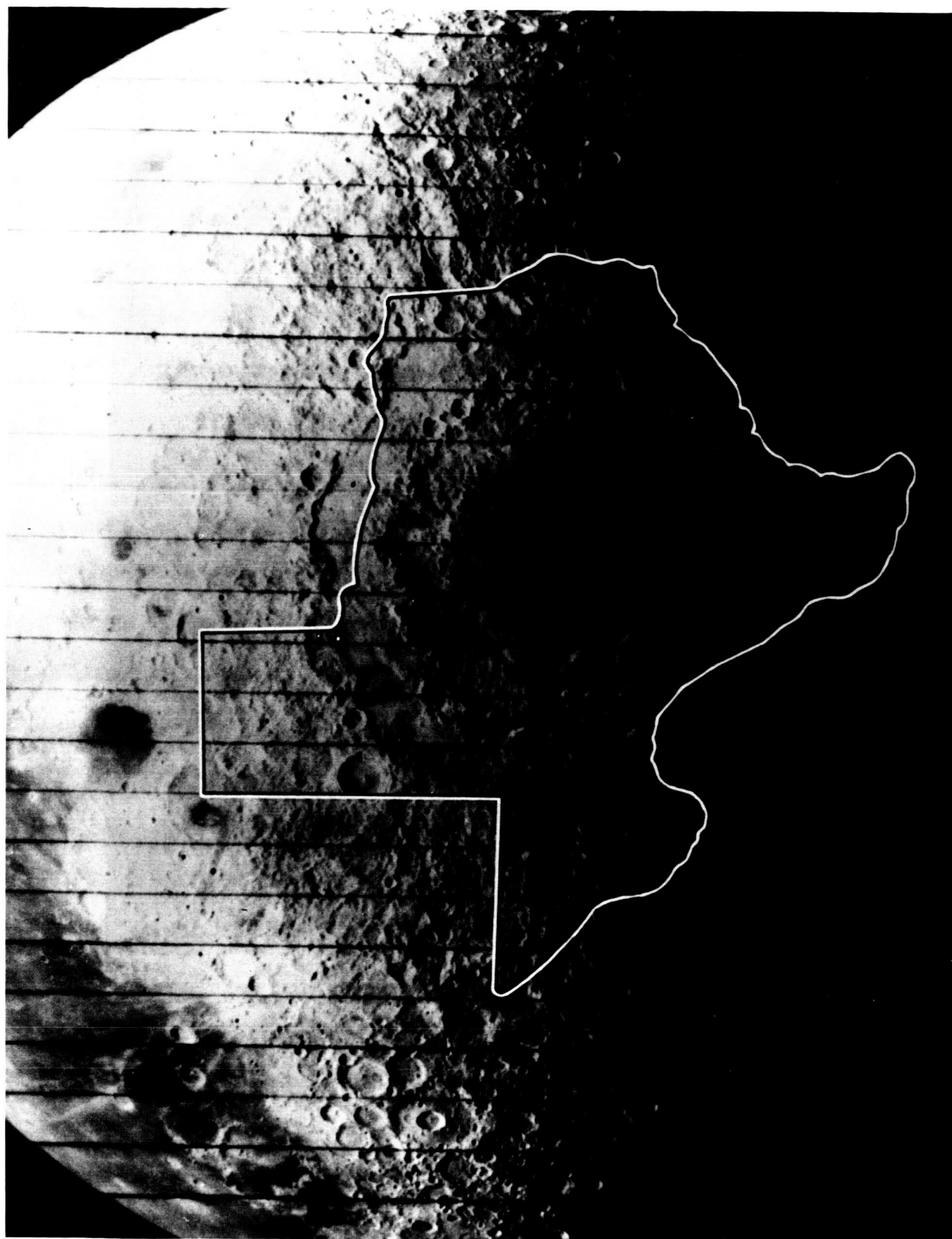


Photo 37 – THE ORIENTALE BASIN

83 H 243

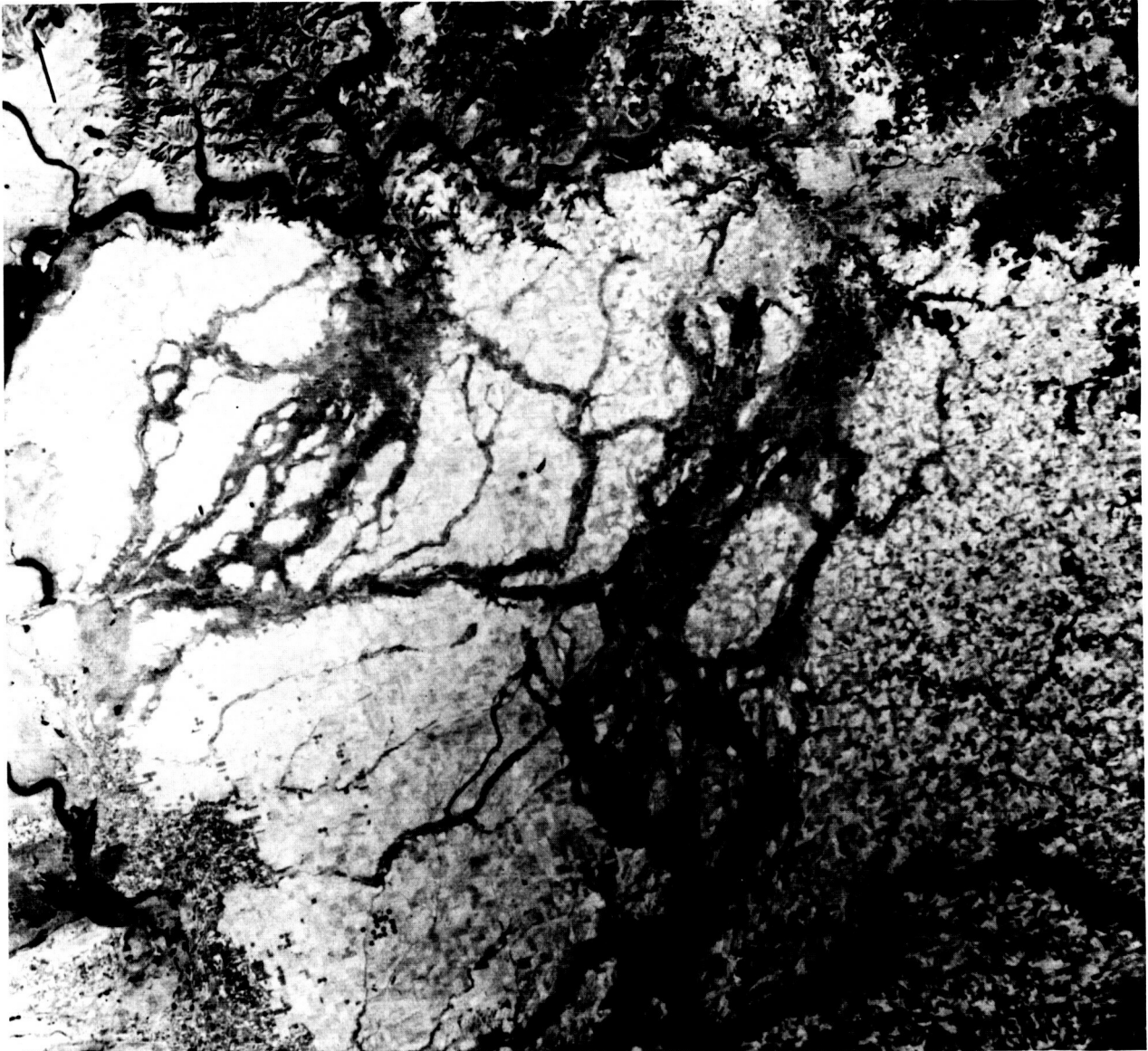


Photo 38 – THE CHANNELED SCABLANDS

76 HC 226

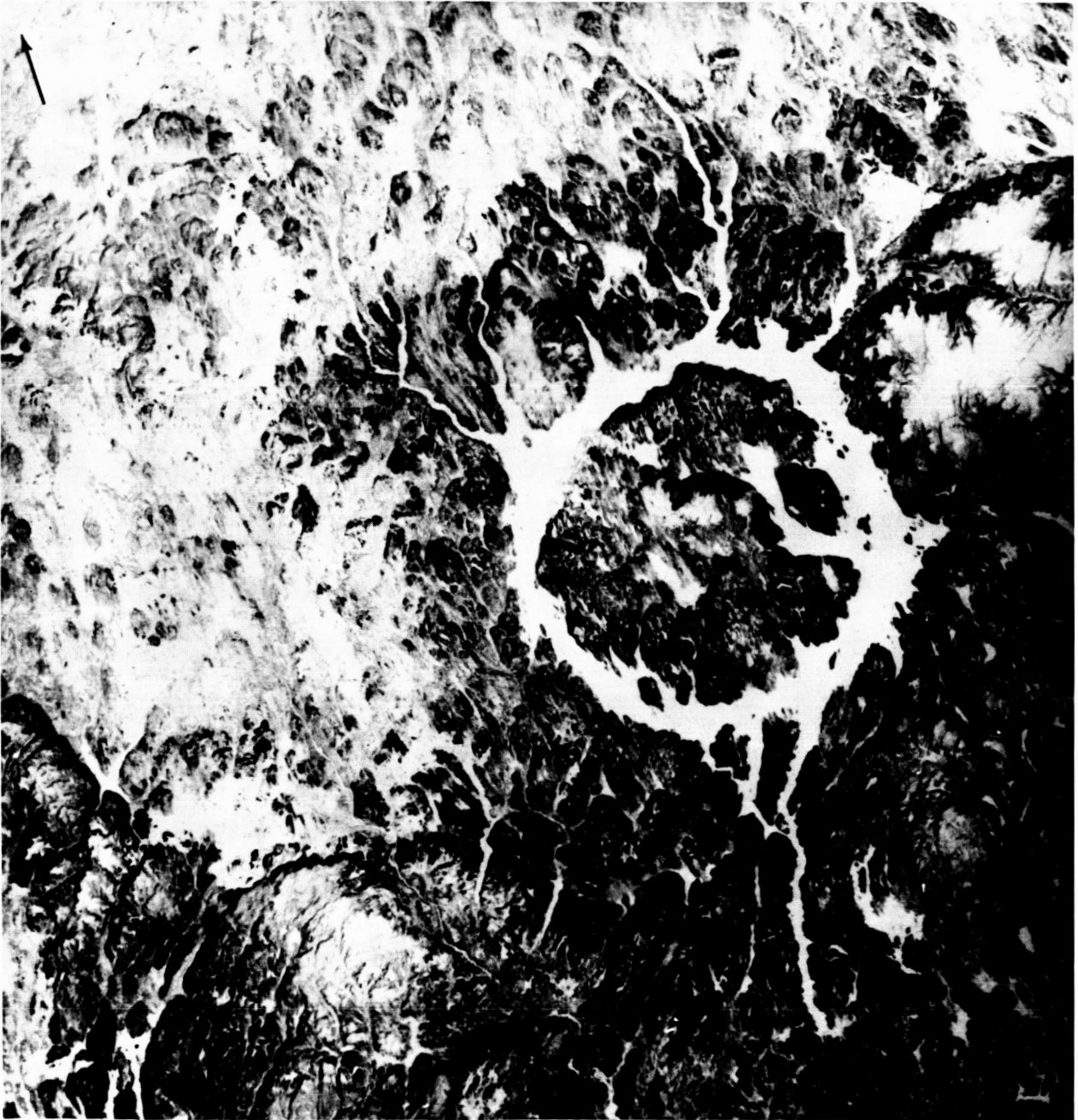


Photo 39 – MANICOUAGAN STRUCTURE

76 HC 260







Photo 40 – MARS

83 H 214  
83 HC 214

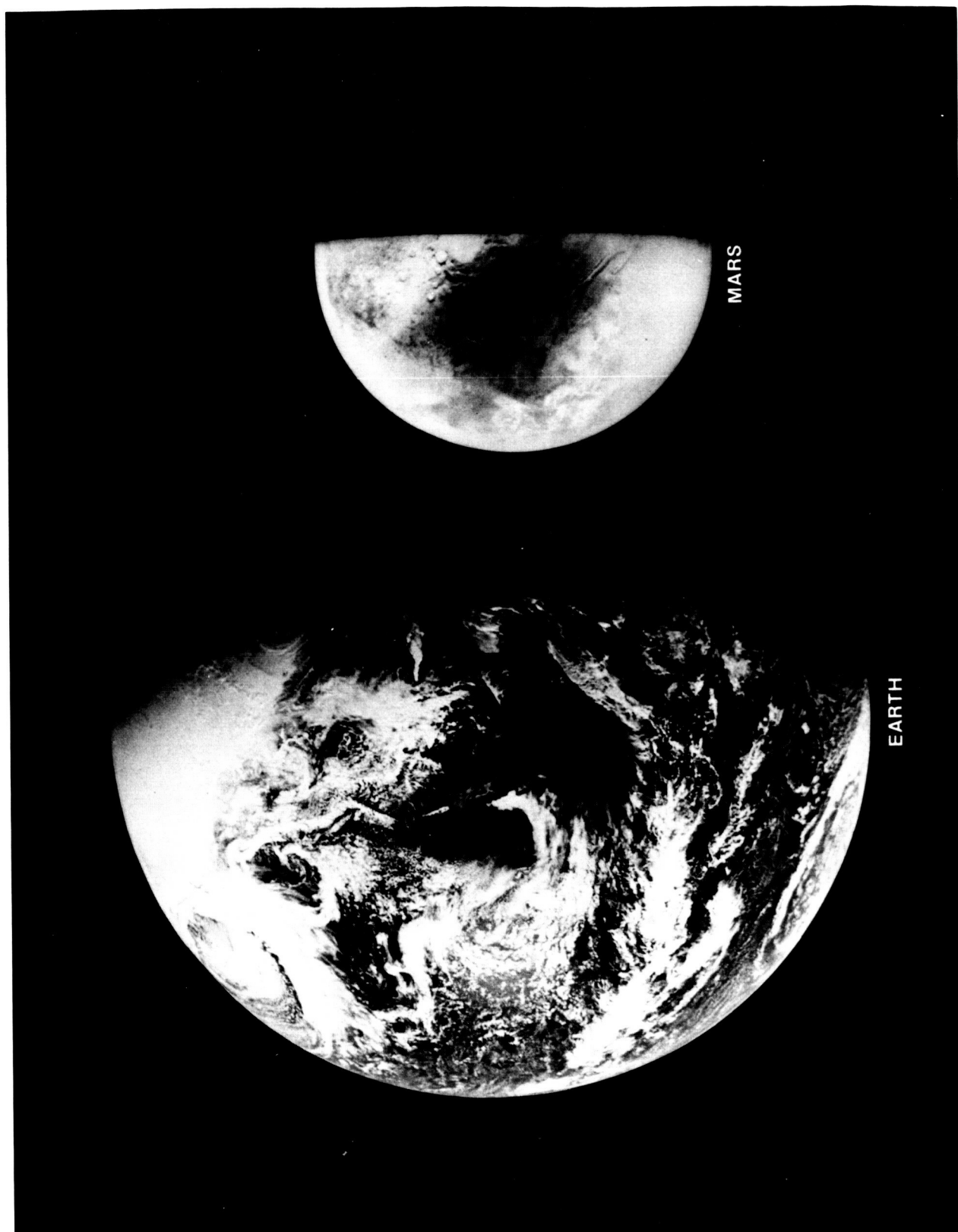


Photo 41 – MARS AND EARTH

83 H 230

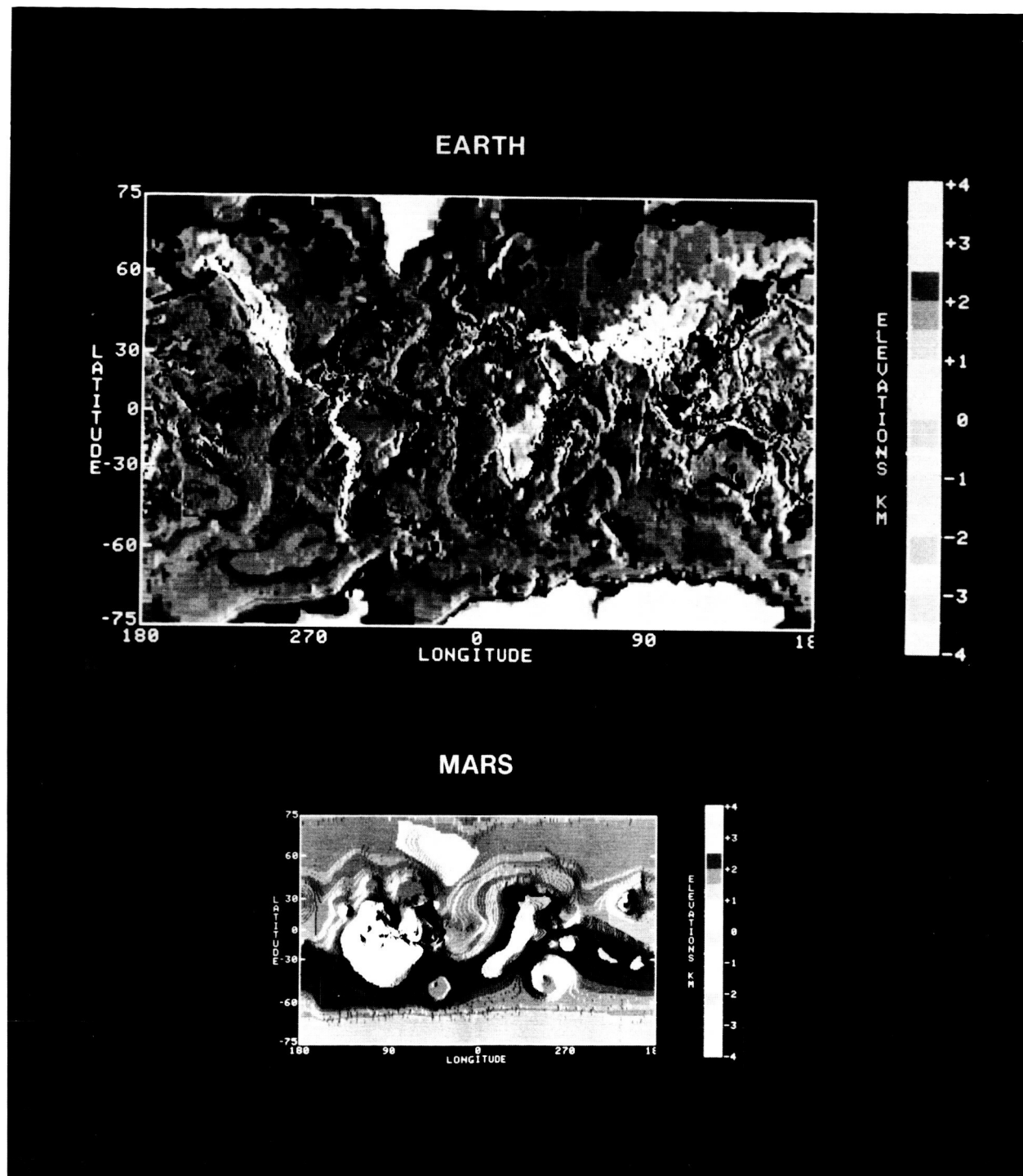


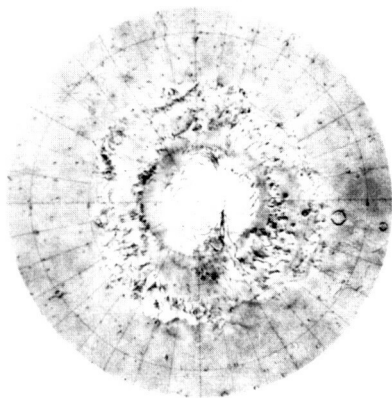
Photo 42 — MARS AND EARTH

84 H 593

# MARS



SOUTH POLAR REGION



NORTH POLAR REGION

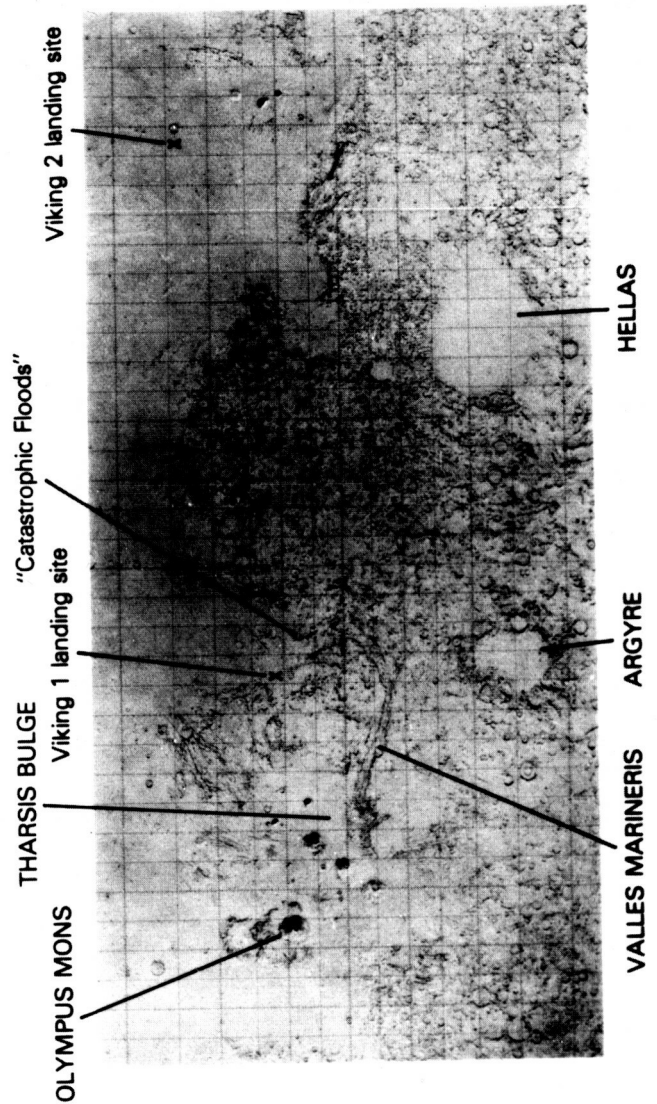


Photo 43 – SELECTED MARTIAN LANDFORMS

84 H 594

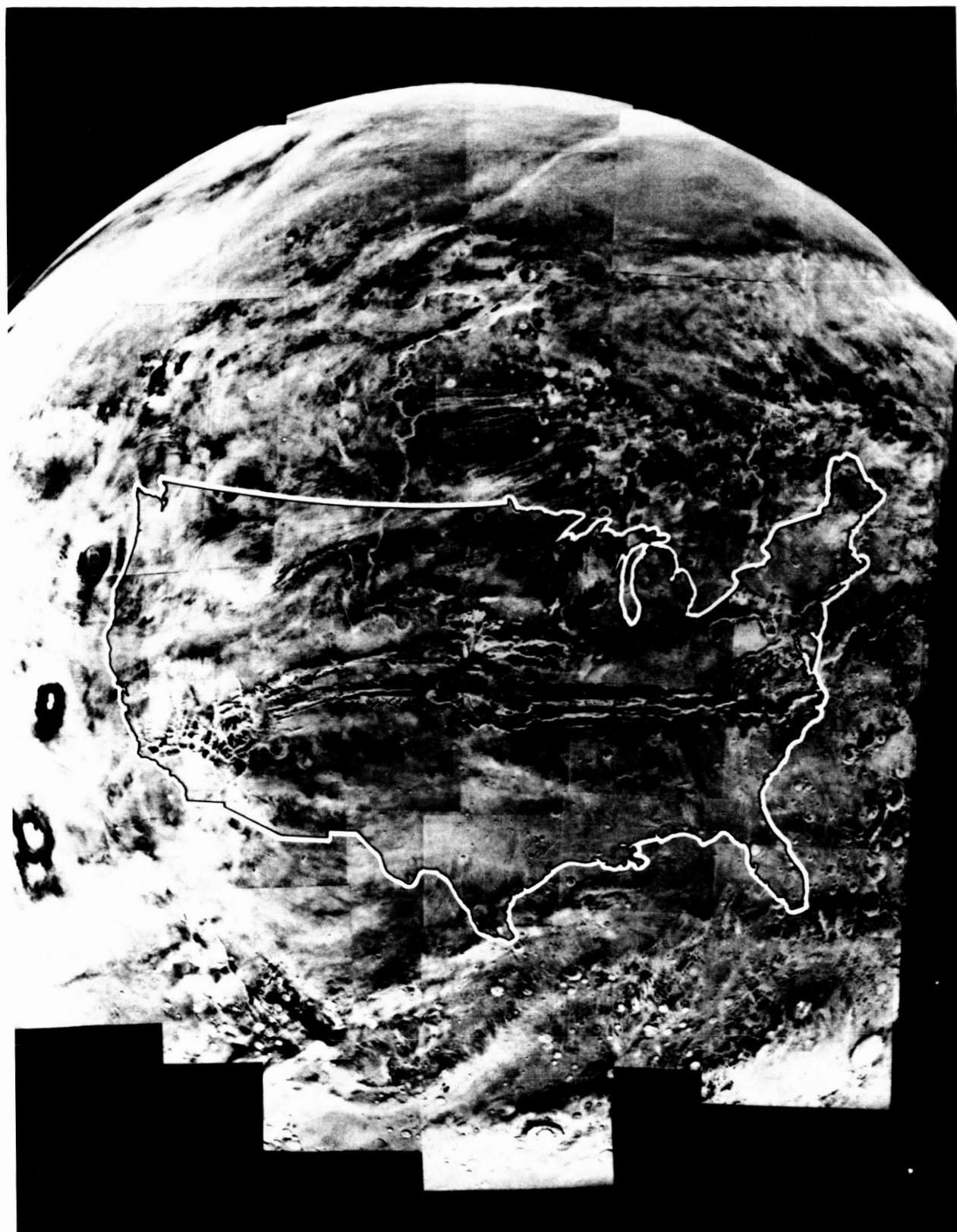


Photo 44 – VALLES MARINERIS (#1)

83 H 244

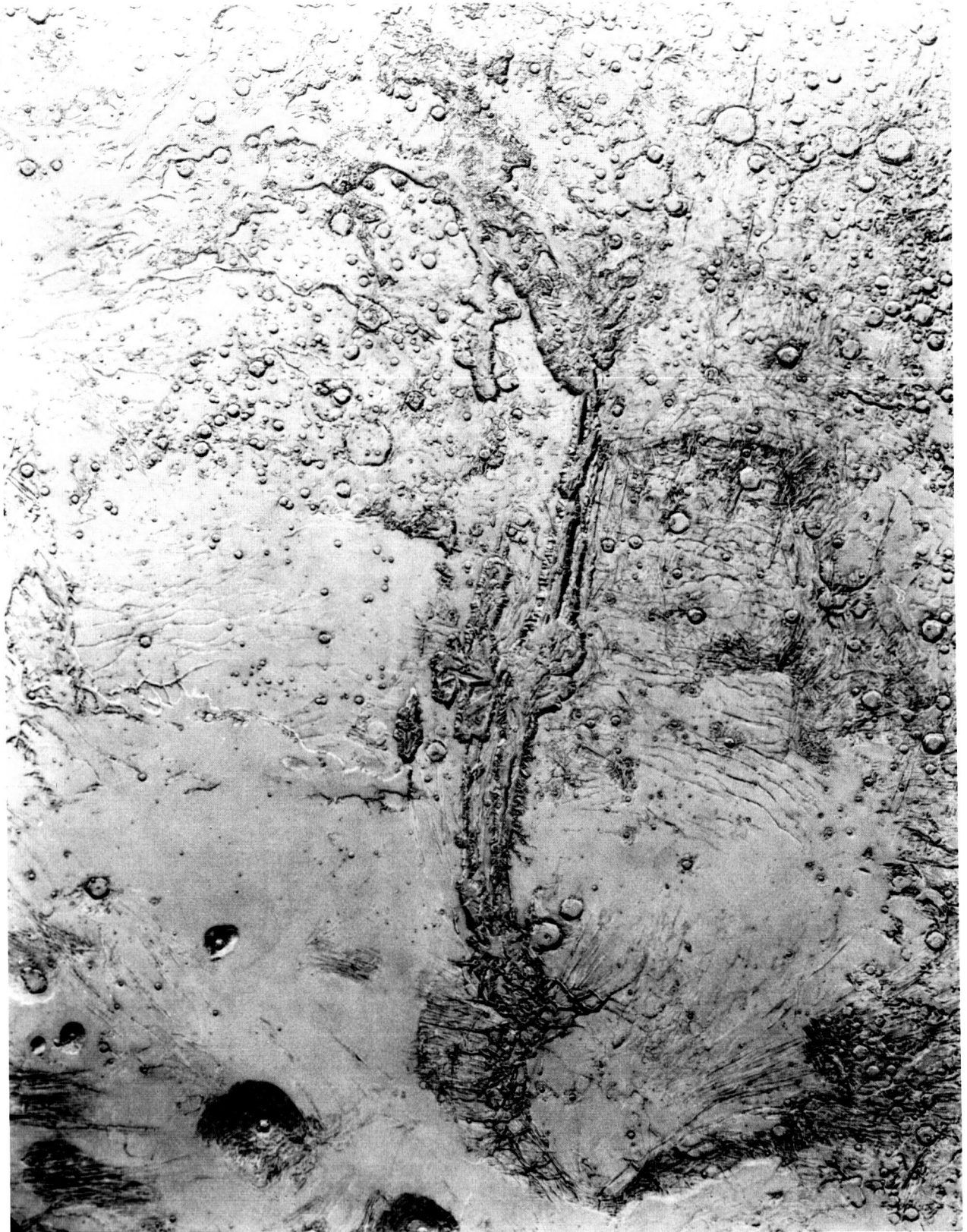


Photo 45 – VALLES MARINERIS (#2)

84 H 596



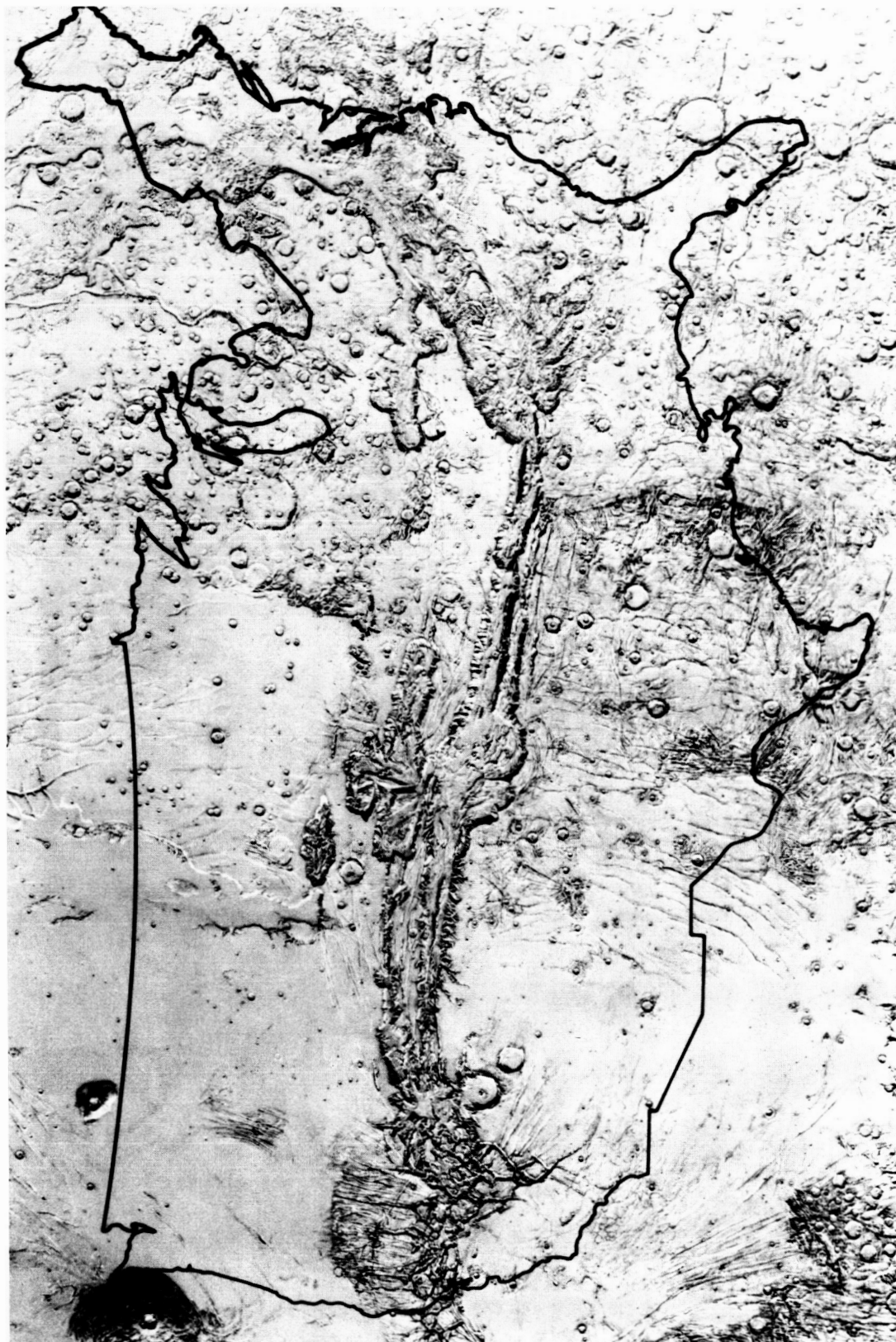


Photo 46 – VALLES MARINERIS (#3)

84 H 595

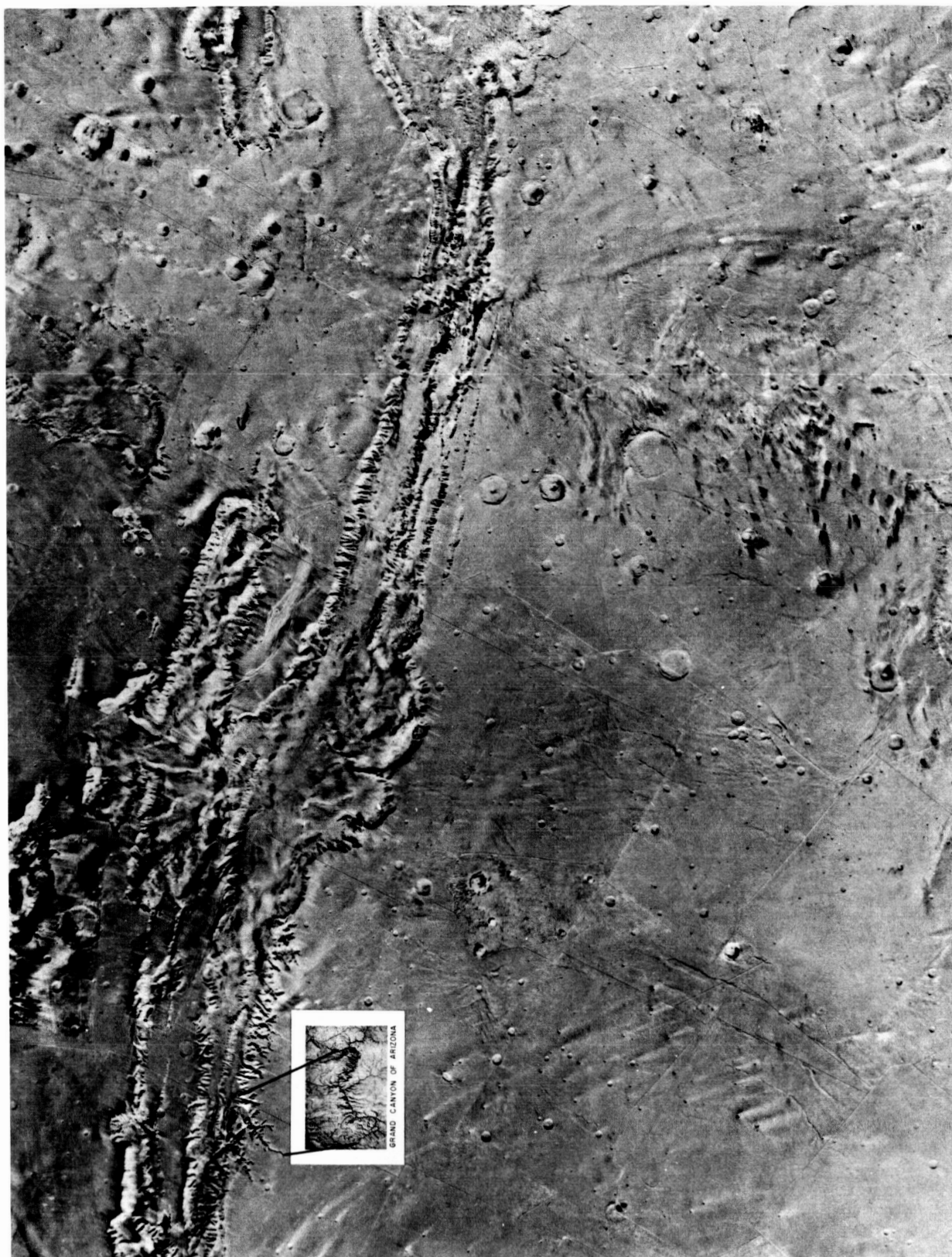


Photo 47 – VALLES MARINERIS AND THE GRAND CANYON

75 H 495





Photo 48 – THE THARSIS BULGE (#1)

84 H 427

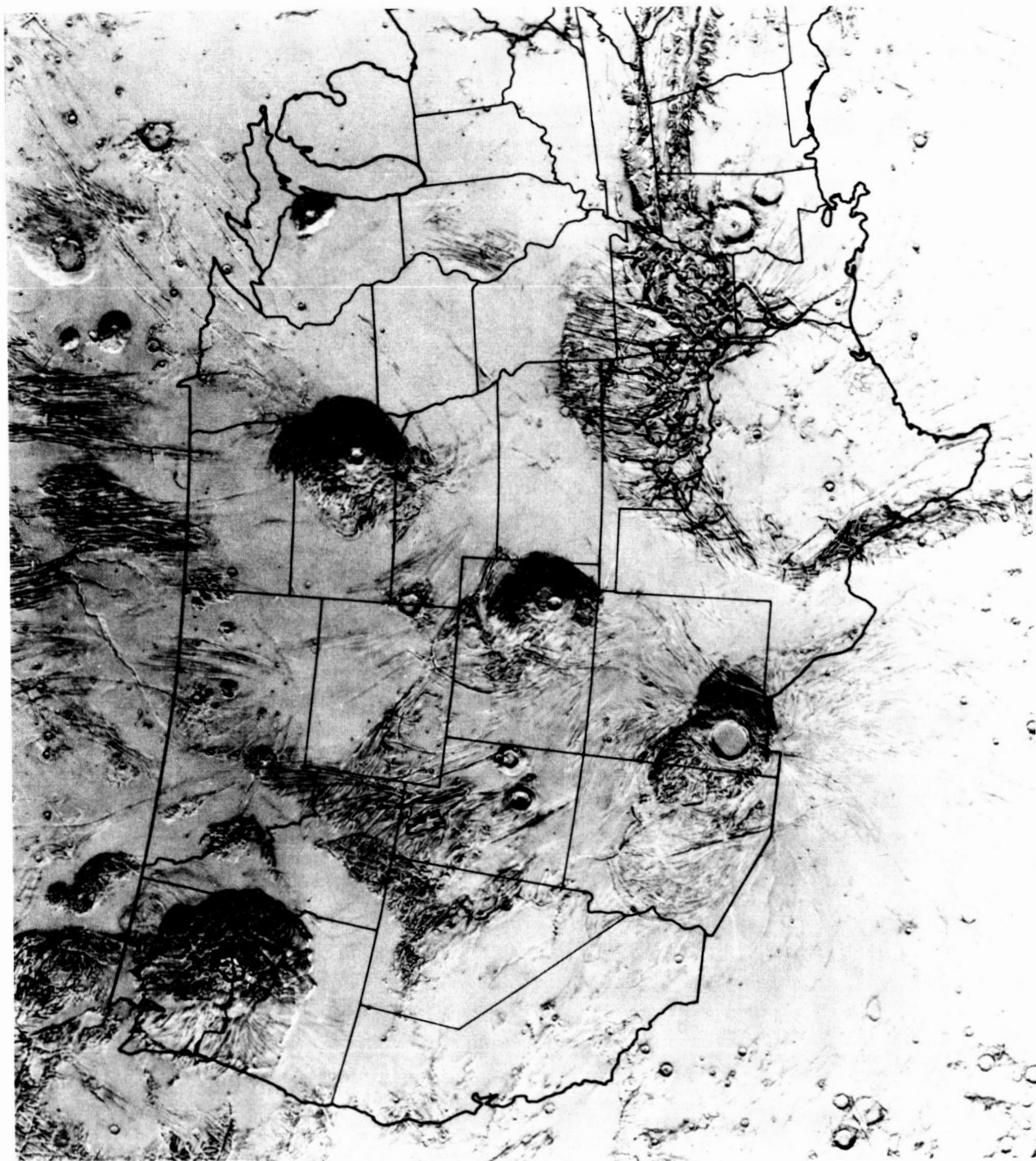


Photo 49 – THE THARSIS BULGE (#2)

84 H 597



Photo 50 – THE THARSIS BULGE (#3)

83 H 245





Photo 51 – THE THARSIS BULGE (#4)

84 H 599

ASCRAEUS MONS

PAVONIS MONS

ARSIA MONS

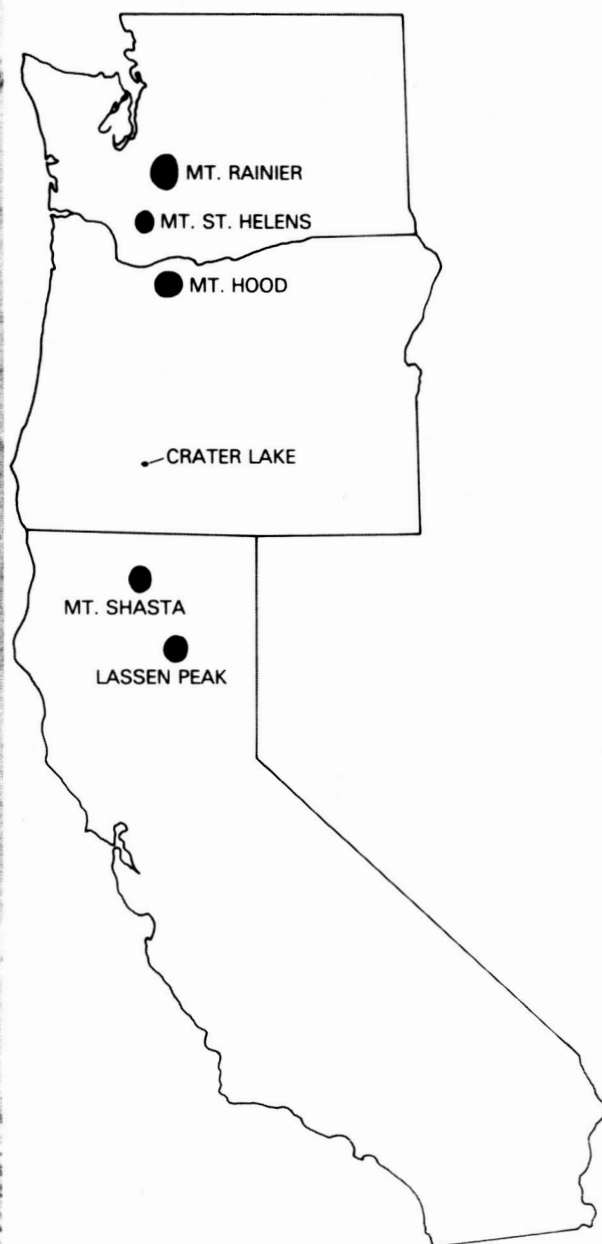


Photo 52 – THE THARSIS BULGE (#5)

85 H 57

# THARSIS BULGE CROSS SECTIONS\*

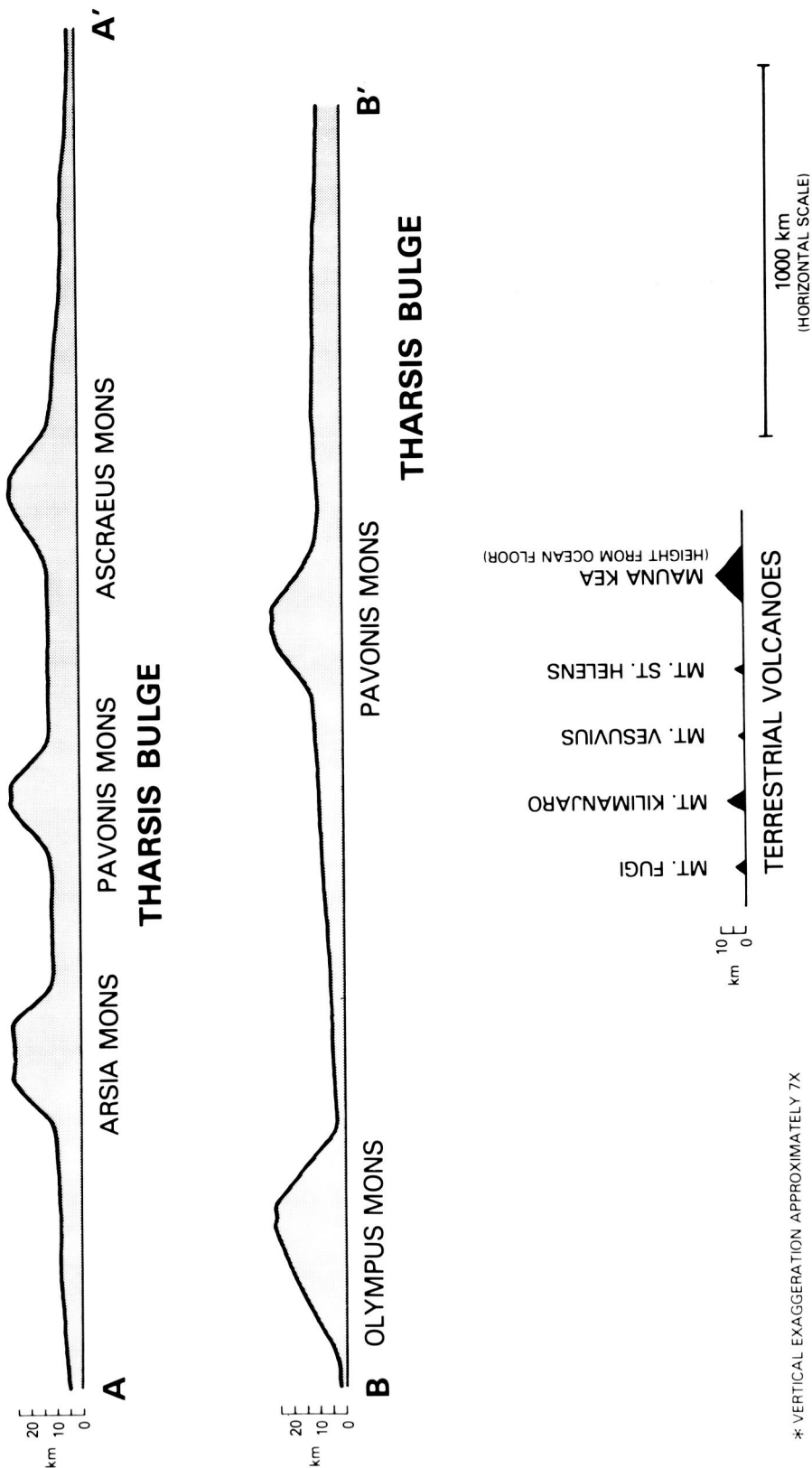


Photo 53 – THARSIS BULGE (#6) CROSS SECTIONS

\* VERTICAL EXAGGERATION APPROXIMATELY 7X

84 H 598

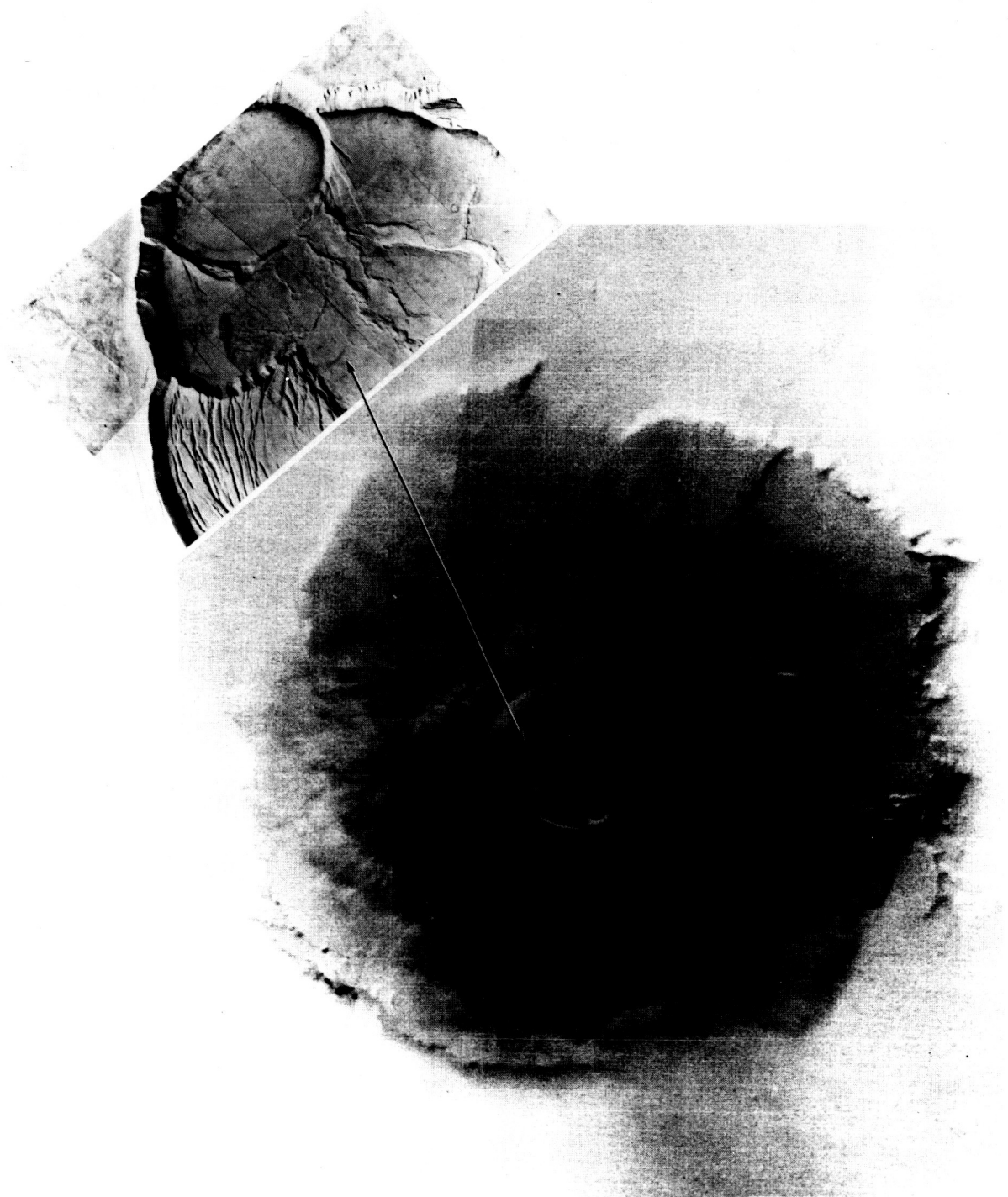


Photo 54 – OLYMPUS MONS (#1)

83 H 249

Part II: PHOTOGRAPHIC COMPARISONS

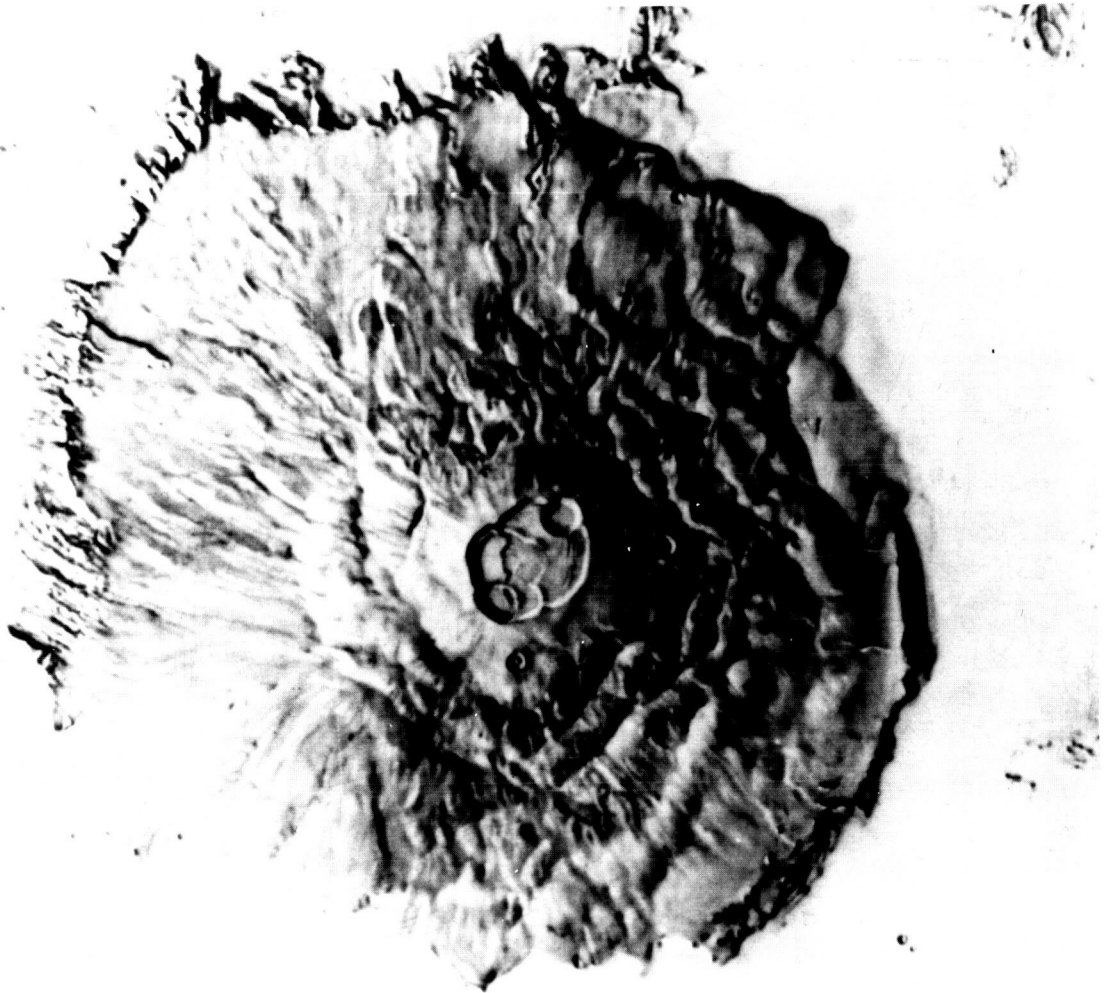


Photo 55 – OLYMPUS MONS (#2)

84 H 424



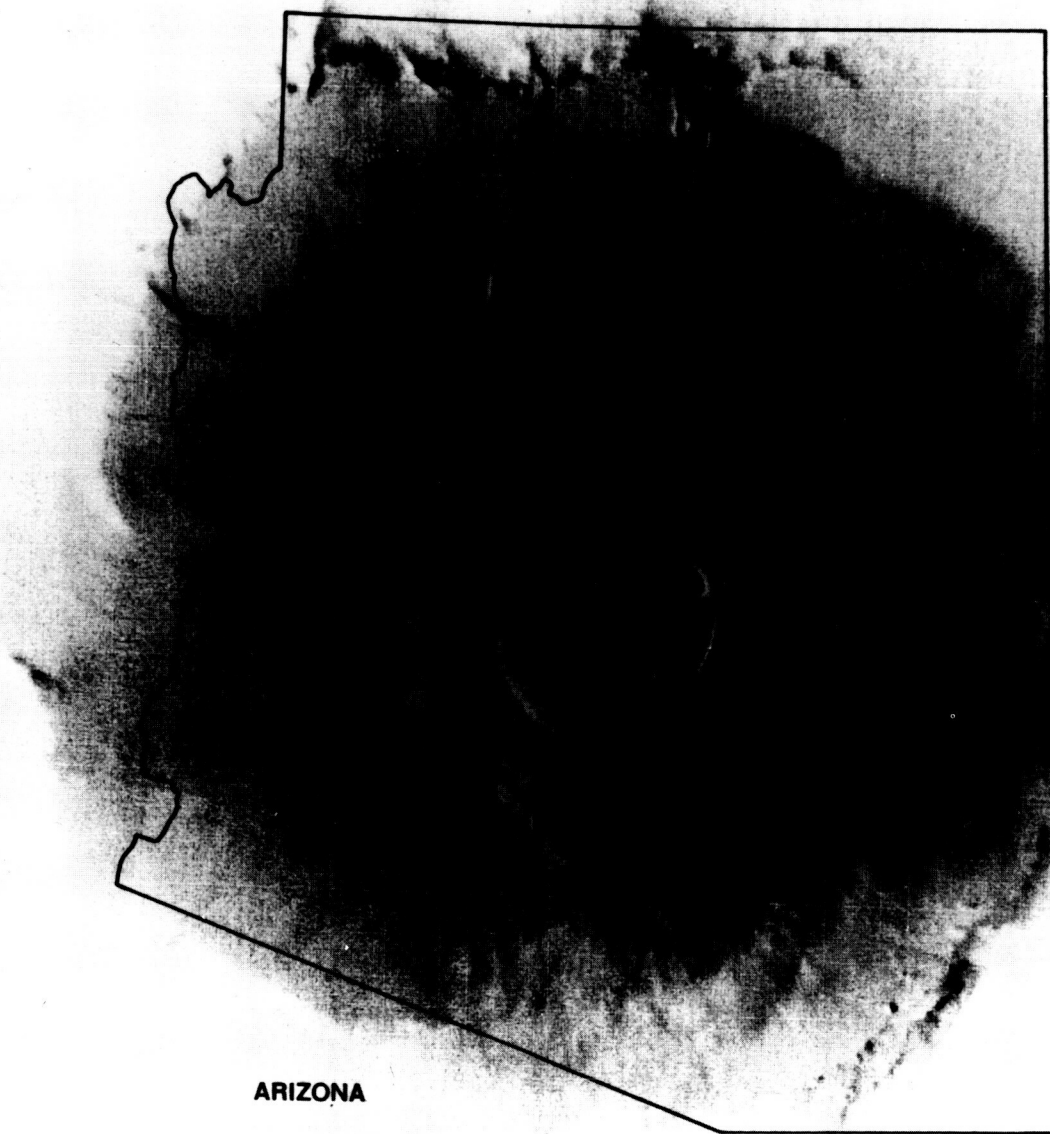


Photo 56 – OLYMPUS MONS (#3)

83 H 247

Part II: PHOTOGRAPHIC COMPARISONS

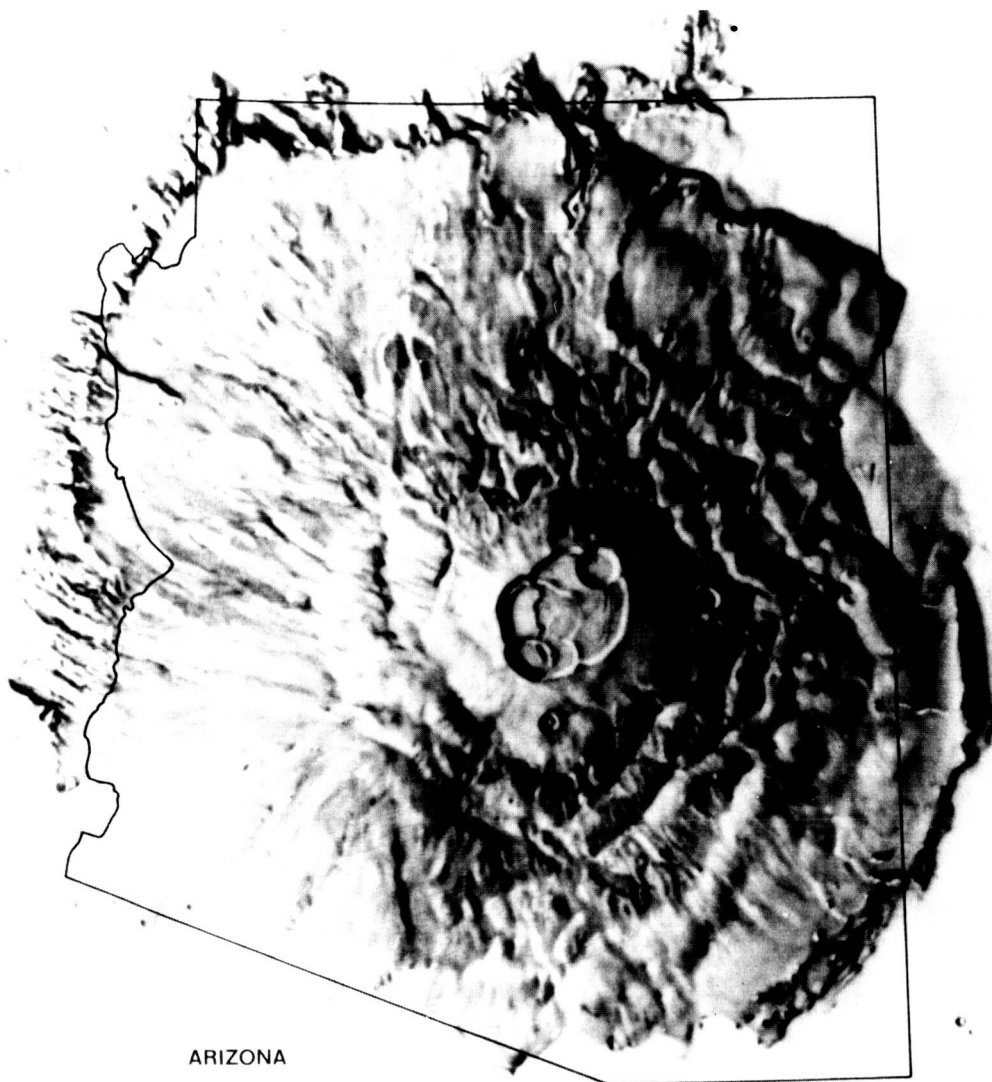


Photo 57 – OLYMPUS MONS (#4)

83 H 246

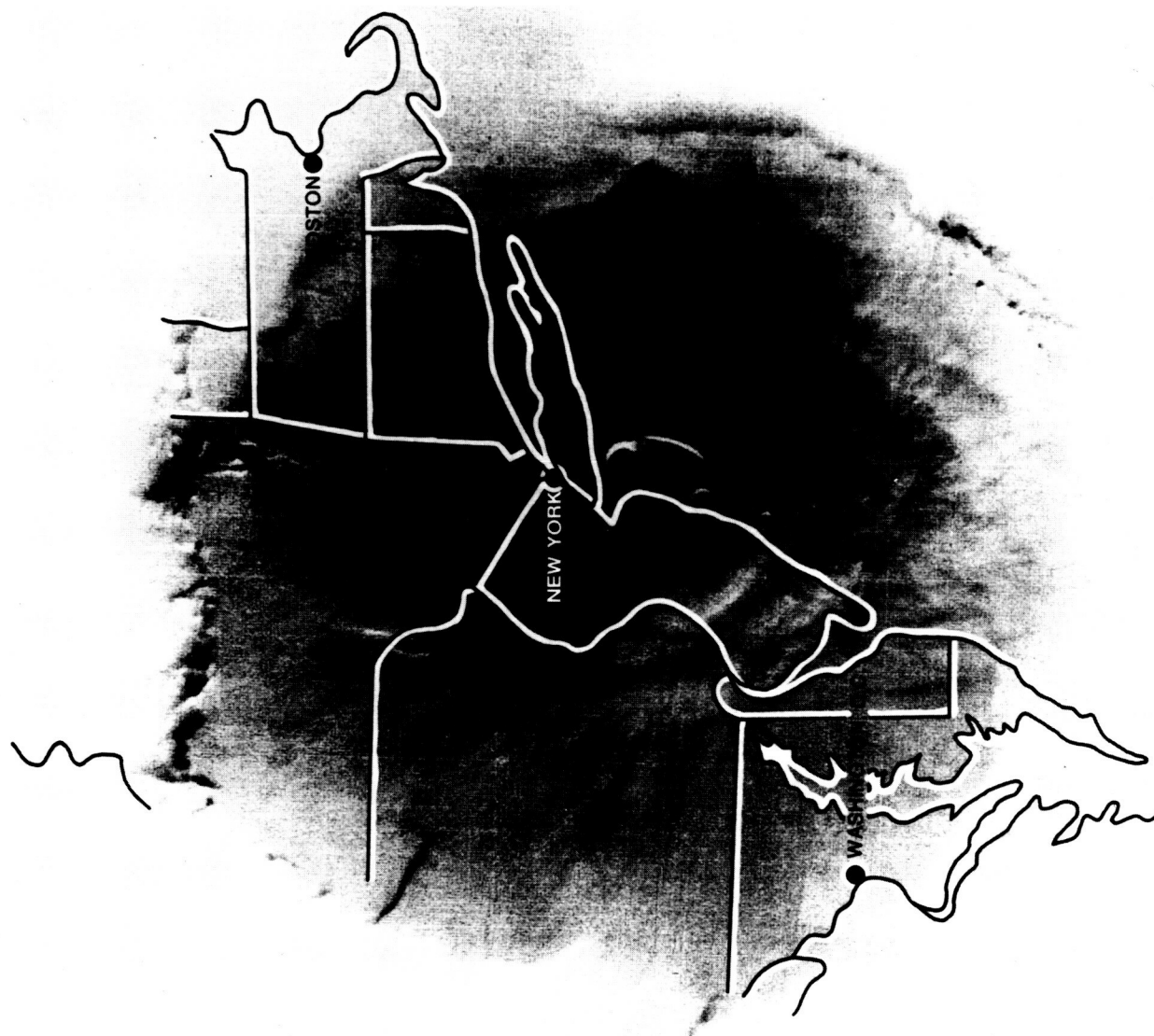
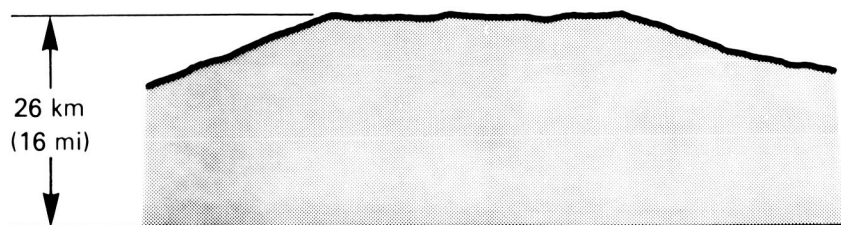


Photo 58 – OLYMPUS MONS (#5)

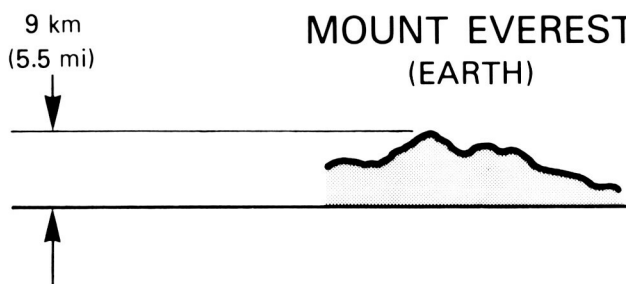
83 H 248

## MAJOR MOUNTAINS COMPARED: \* EARTH AND MARS

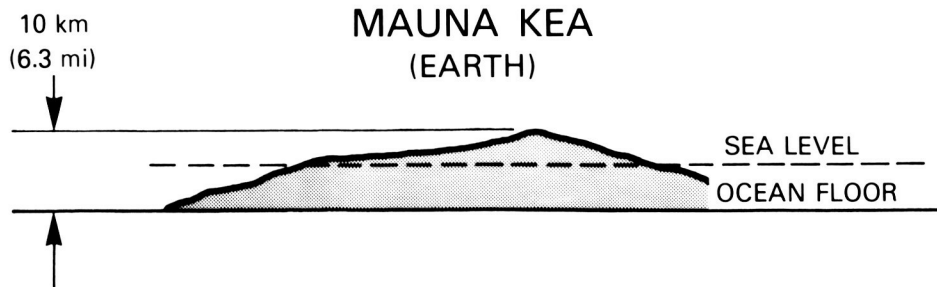
### OLYMPUS MONS (MARS)



### MOUNT EVEREST (EARTH)



### MAUNA KEA (EARTH)



\* VERTICAL EXAGGERATION 2X

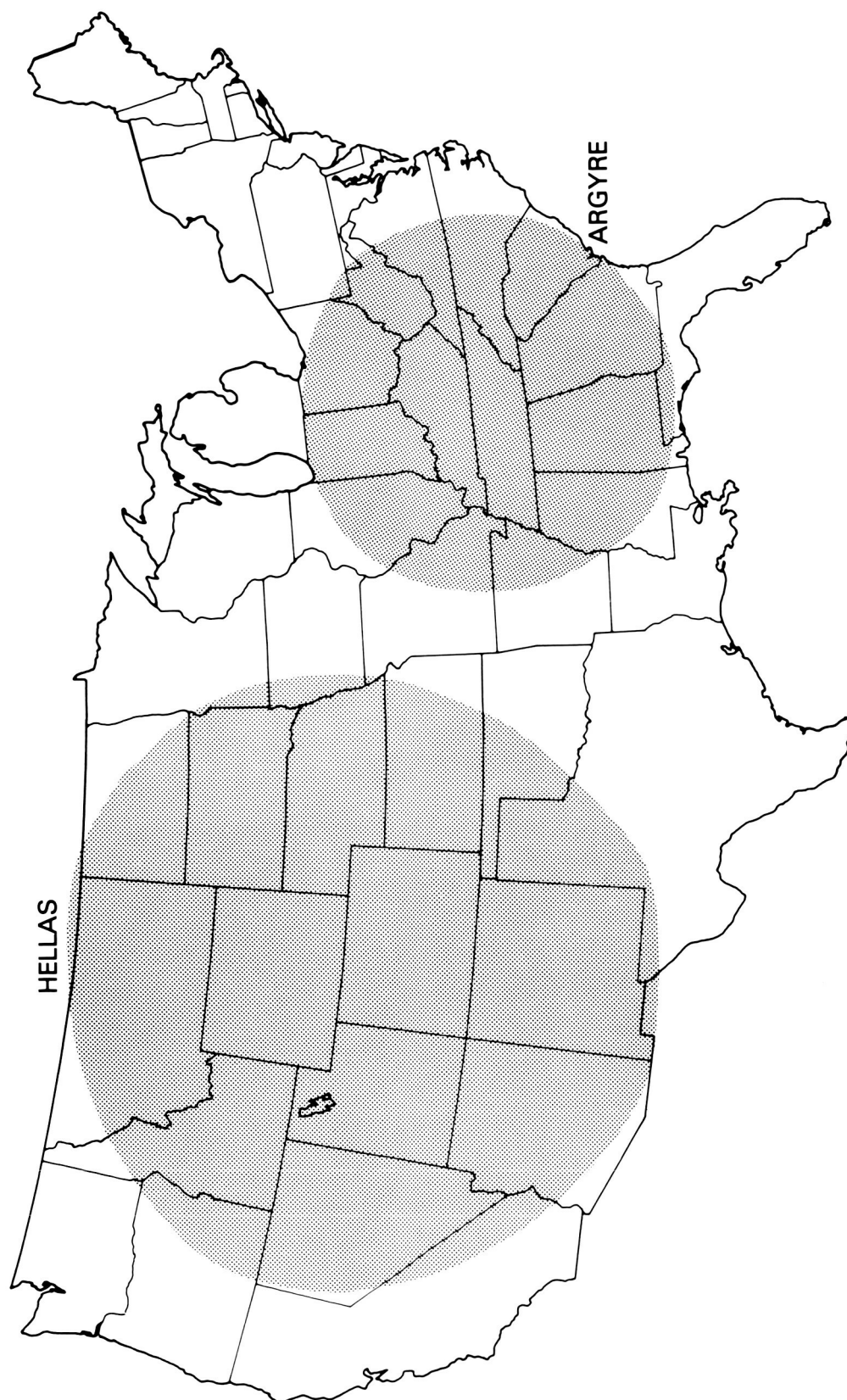


Photo 60 – HELLAS AND ARGYRE

84 H 600

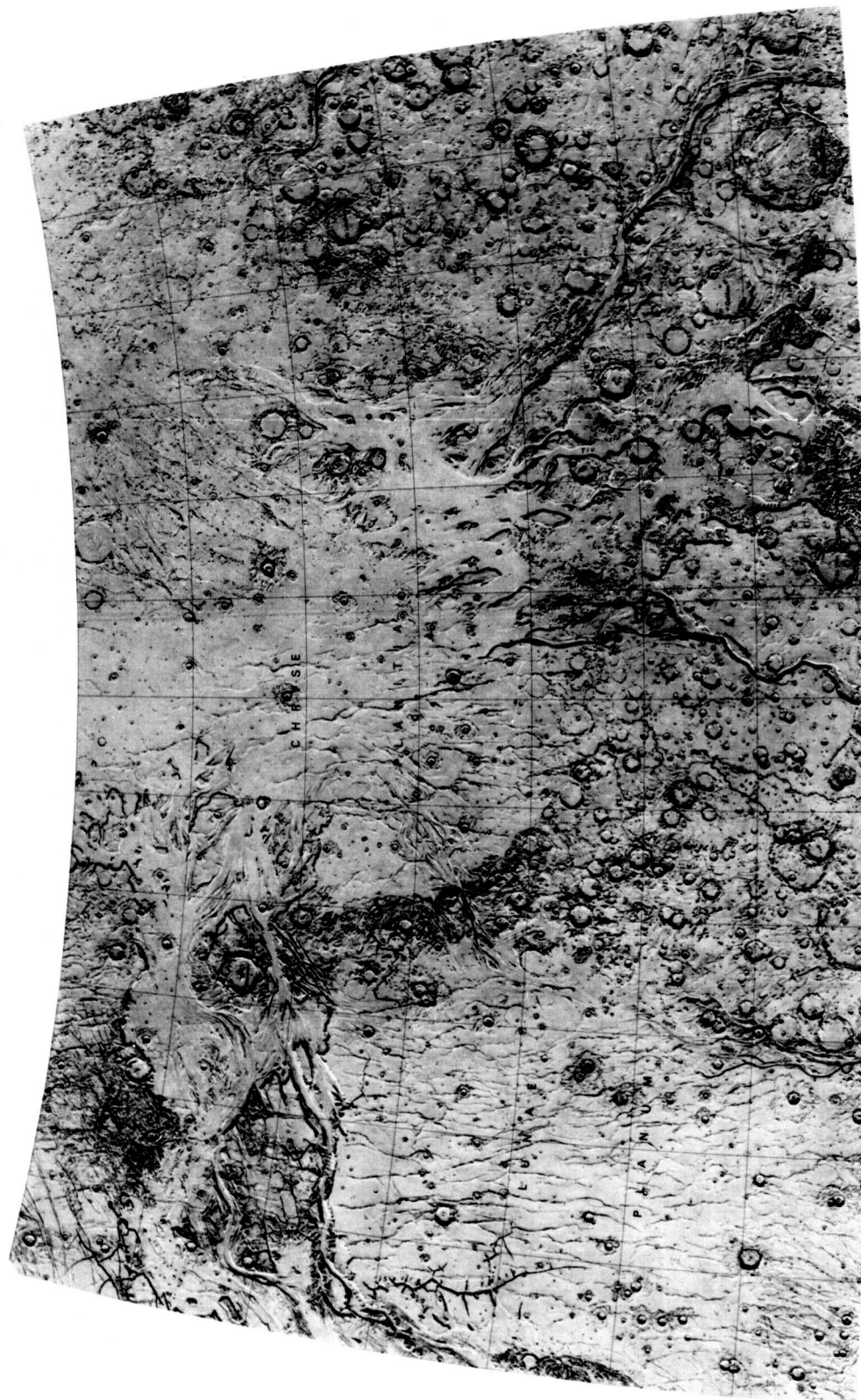


Photo 61 – CATASTROPHIC FLOODS OF MARS (#1)

85 H 58





Photo 62 – CATASTROPHIC FLOODS OF MARS (#2)

85 H 59

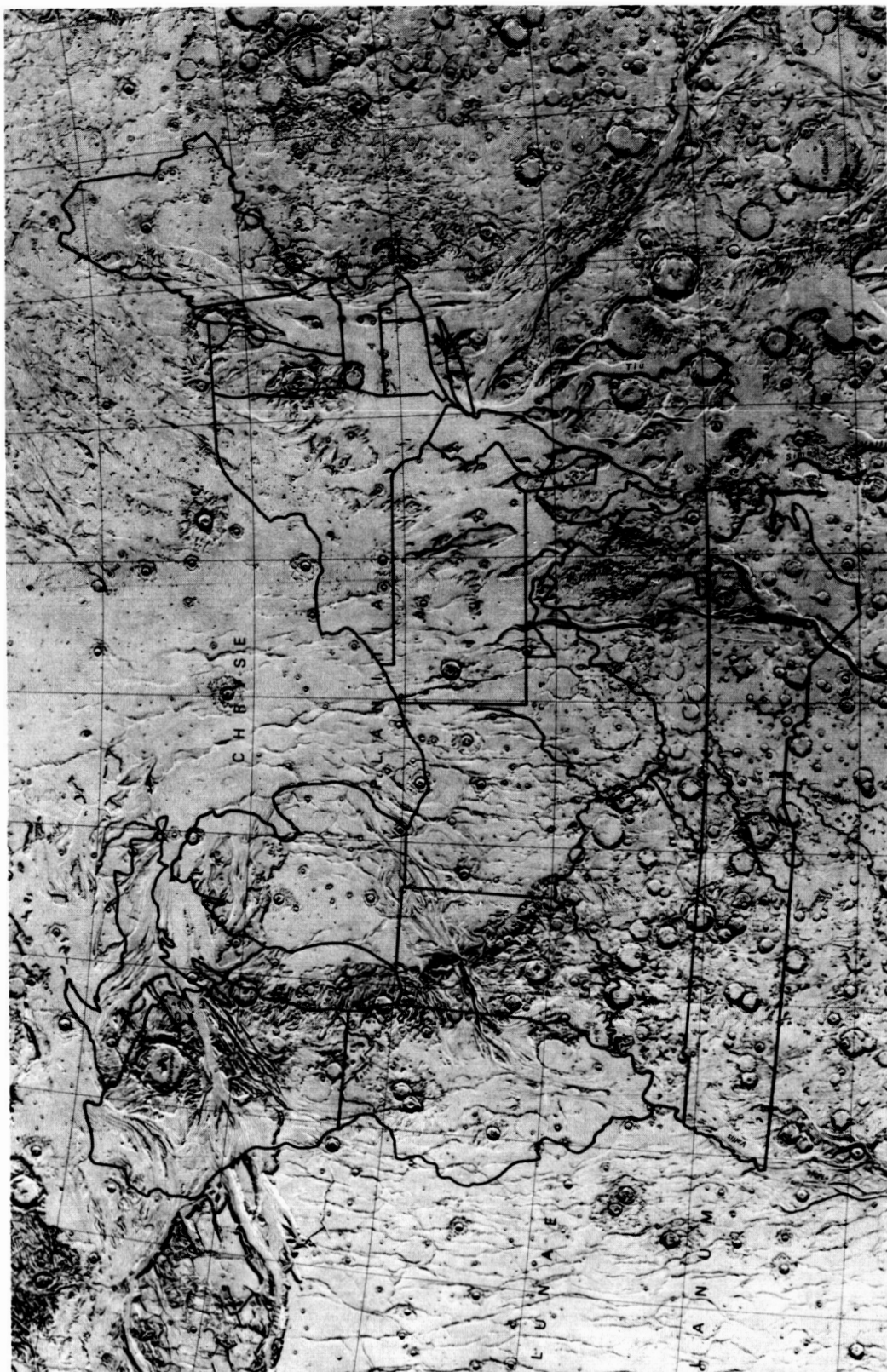


Photo 63 – CATASTROPHIC FLOODS OF MARS (#3)

85 H 60





Photo 64 – CATASTROPHIC FLOODS OF MARS (#4)

84 H 430

# **POLAR COMPARISONS** **NORTH POLAR REGIONS** **SOUTH POLAR REGIONS**

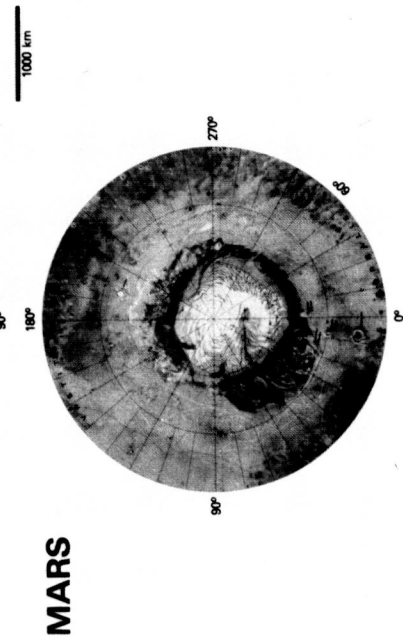
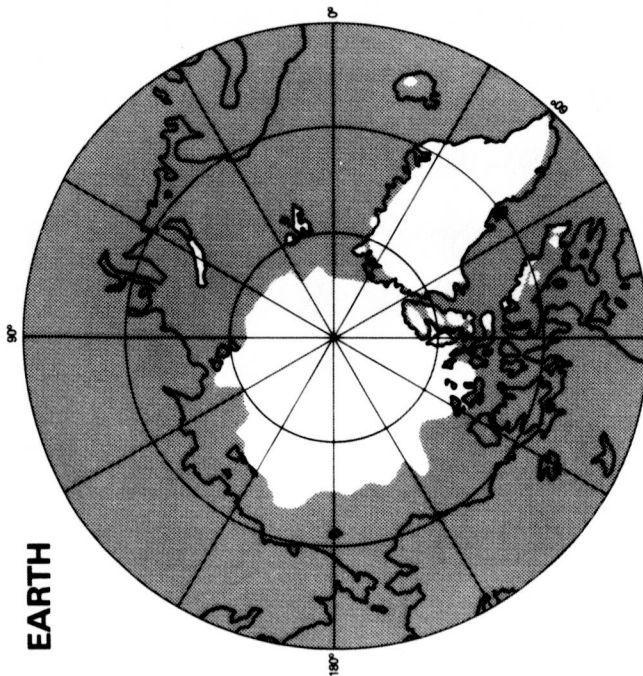
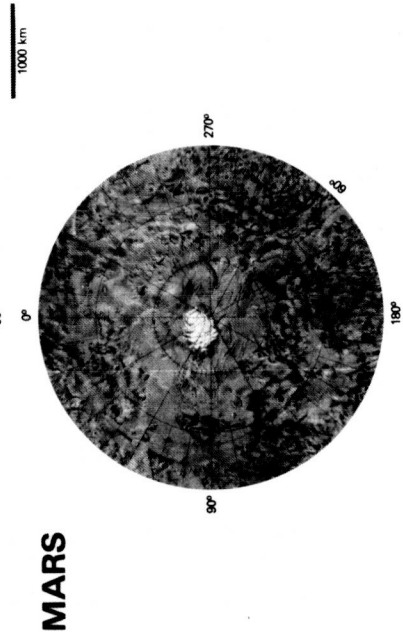
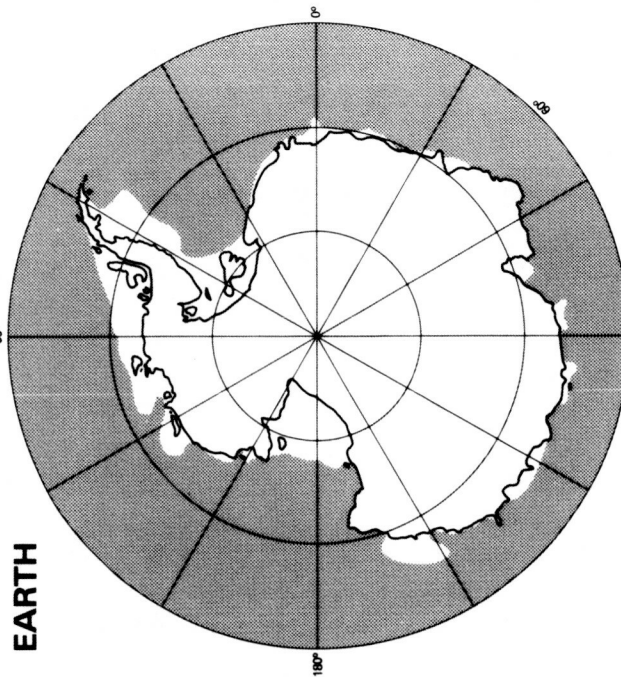
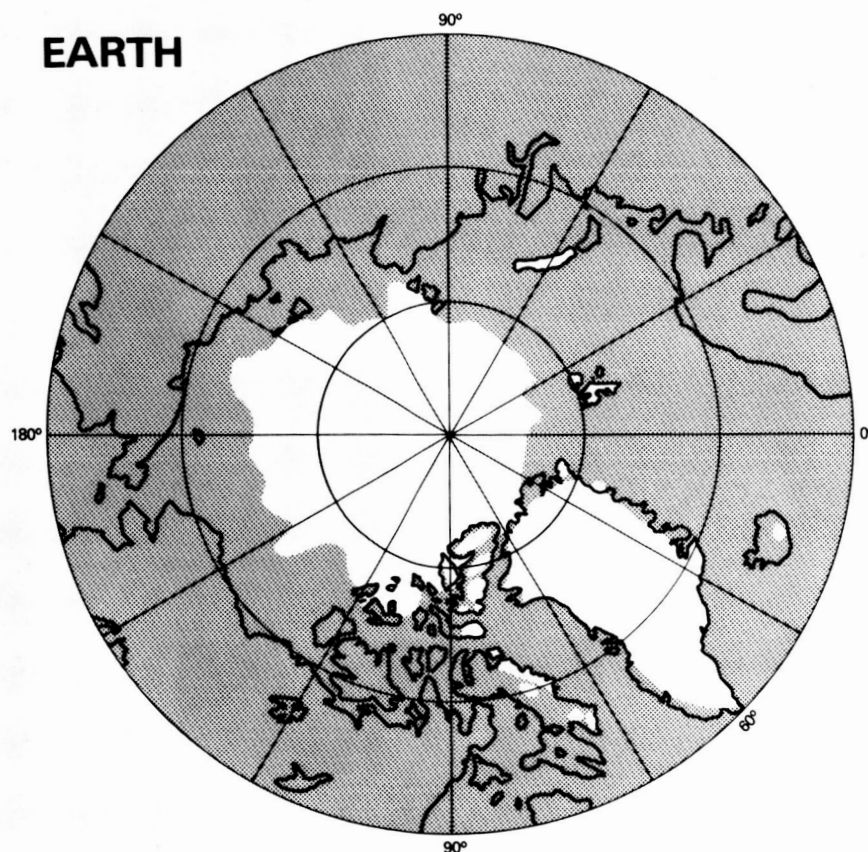


Photo 65 – THE POLAR REGIONS OF EARTH AND MARS

84 H 603

# NORTH POLAR REGIONS

**EARTH**



**MARS**

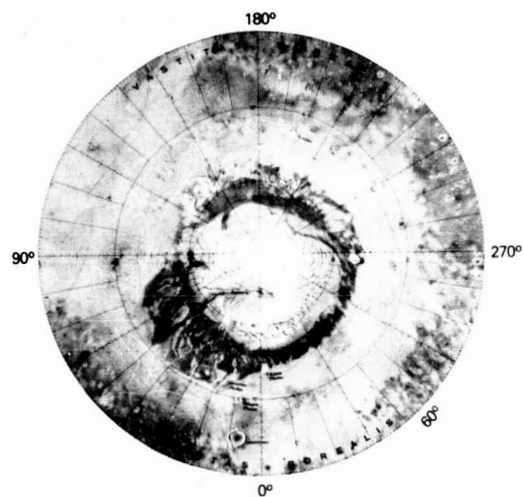
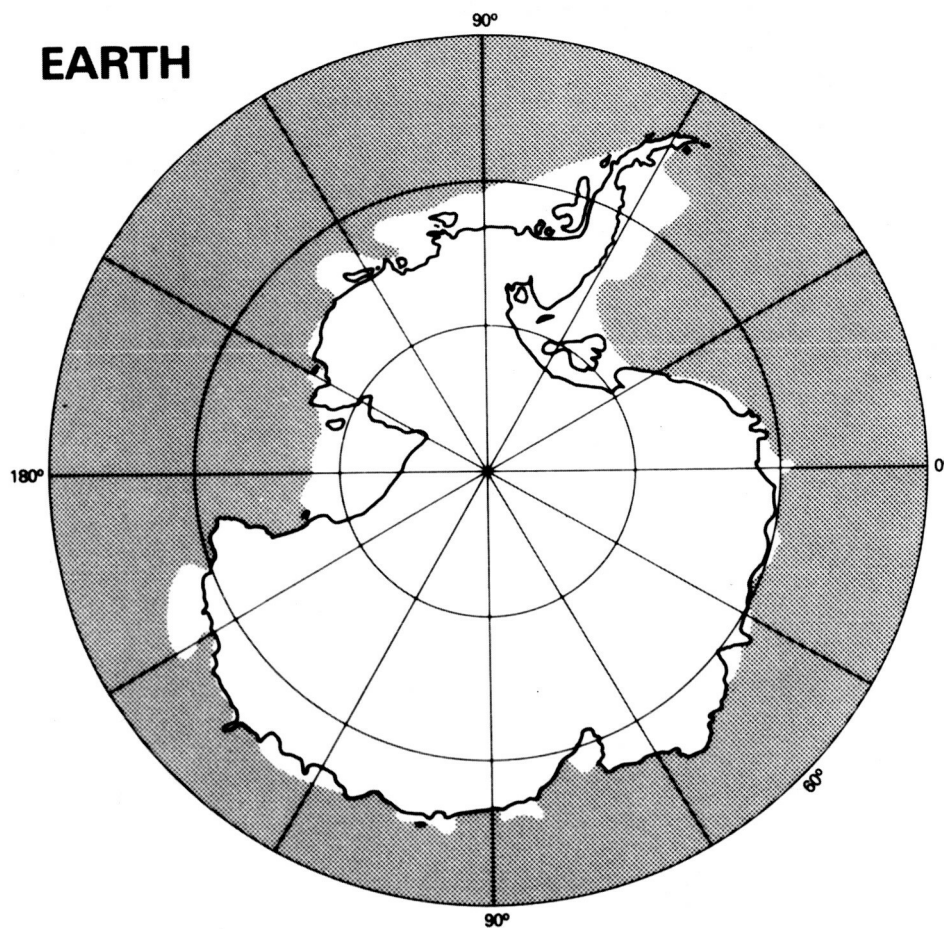


Photo 66 – NORTH POLAR REGIONS

84 H 601

## SOUTH POLAR REGIONS

**EARTH**



**MARS**

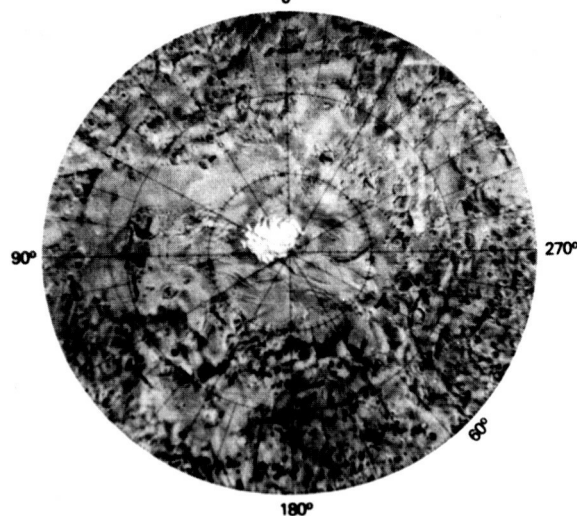


Photo 67 – SOUTH POLAR REGIONS

84 H 602

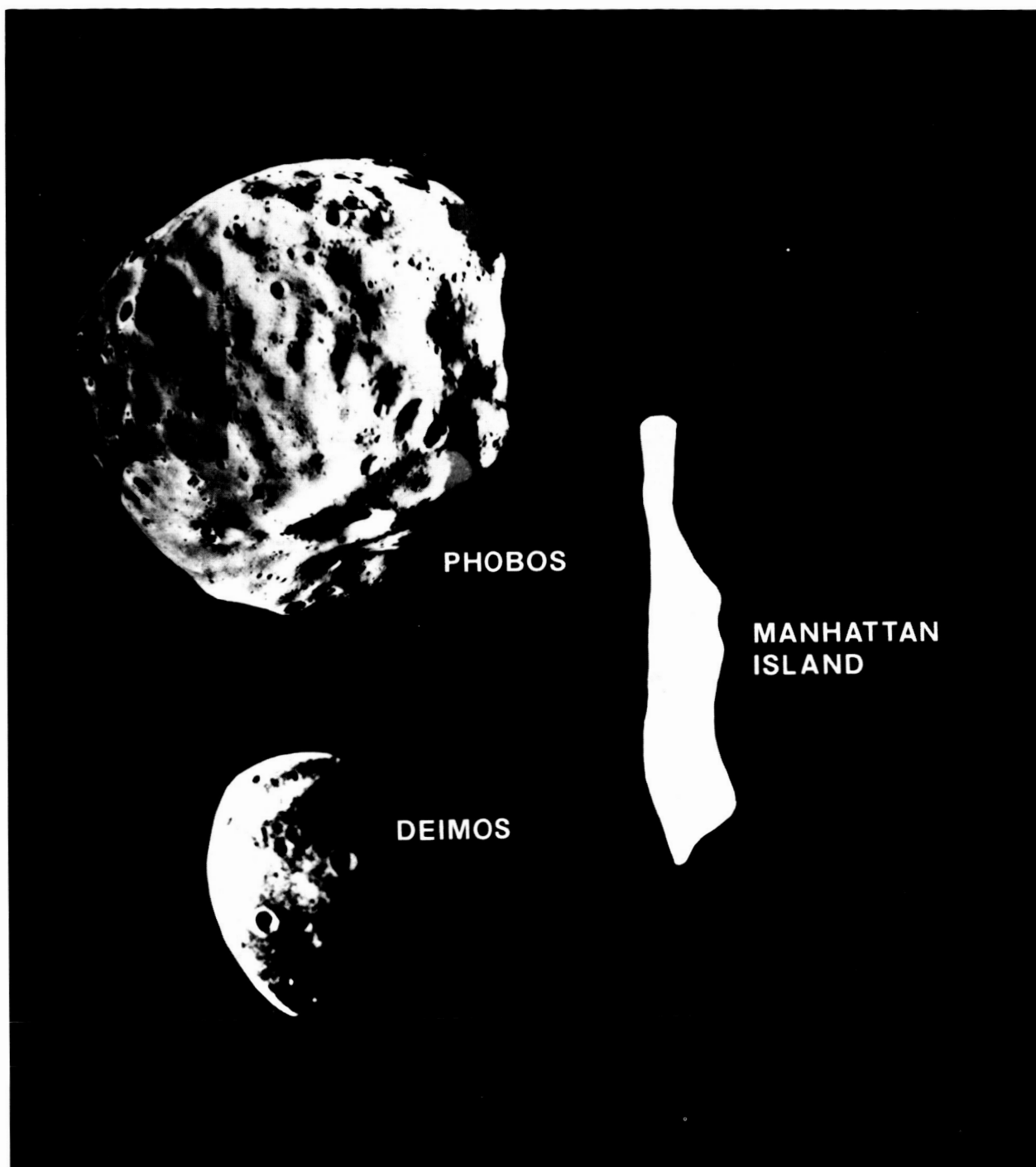


Photo 68 — PHOBOS AND DEIMOS

83 H 226



## VIKING LANDING SITES

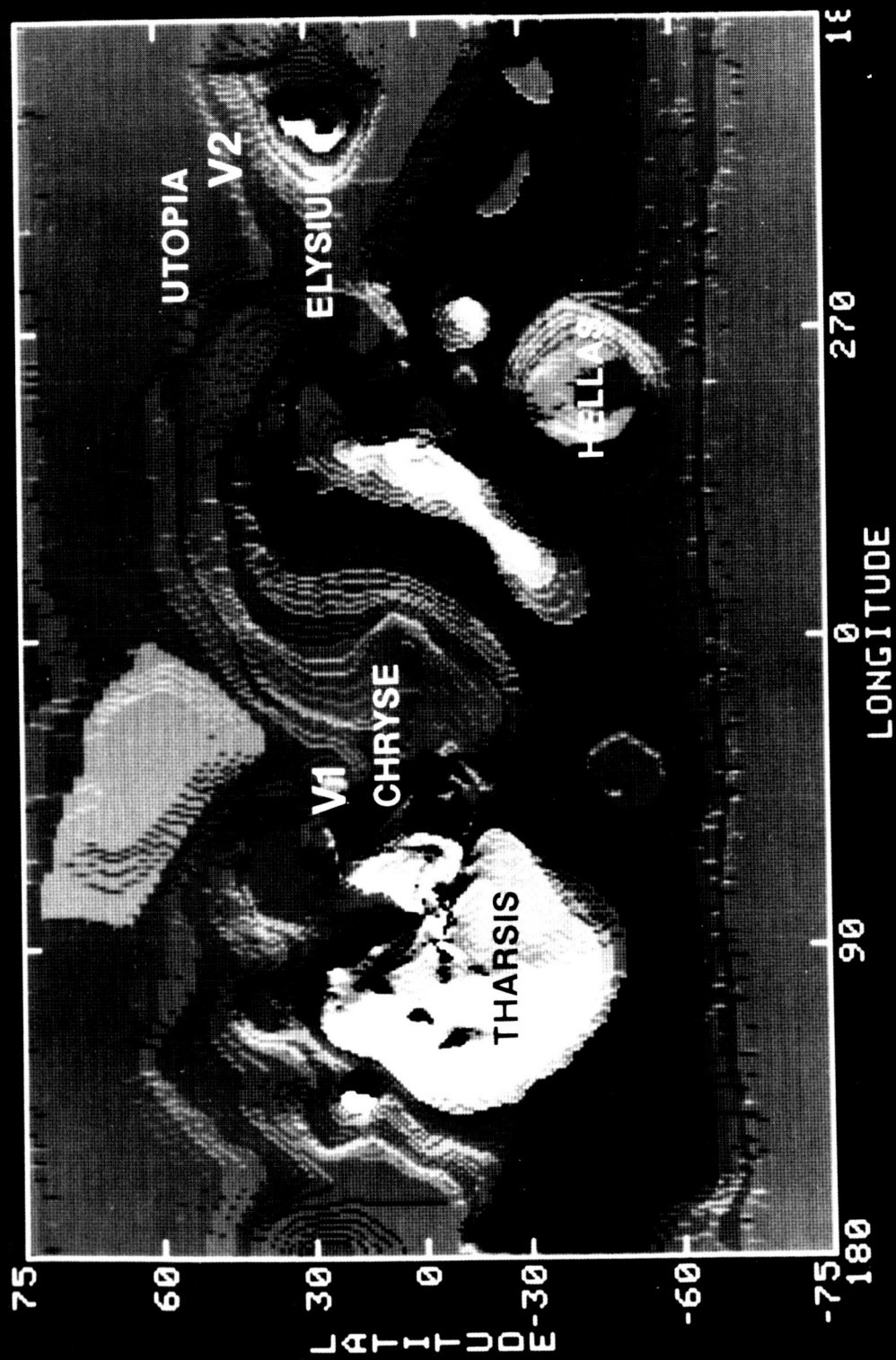


Photo 69 – VIKING LANDING SITES

83 H 258

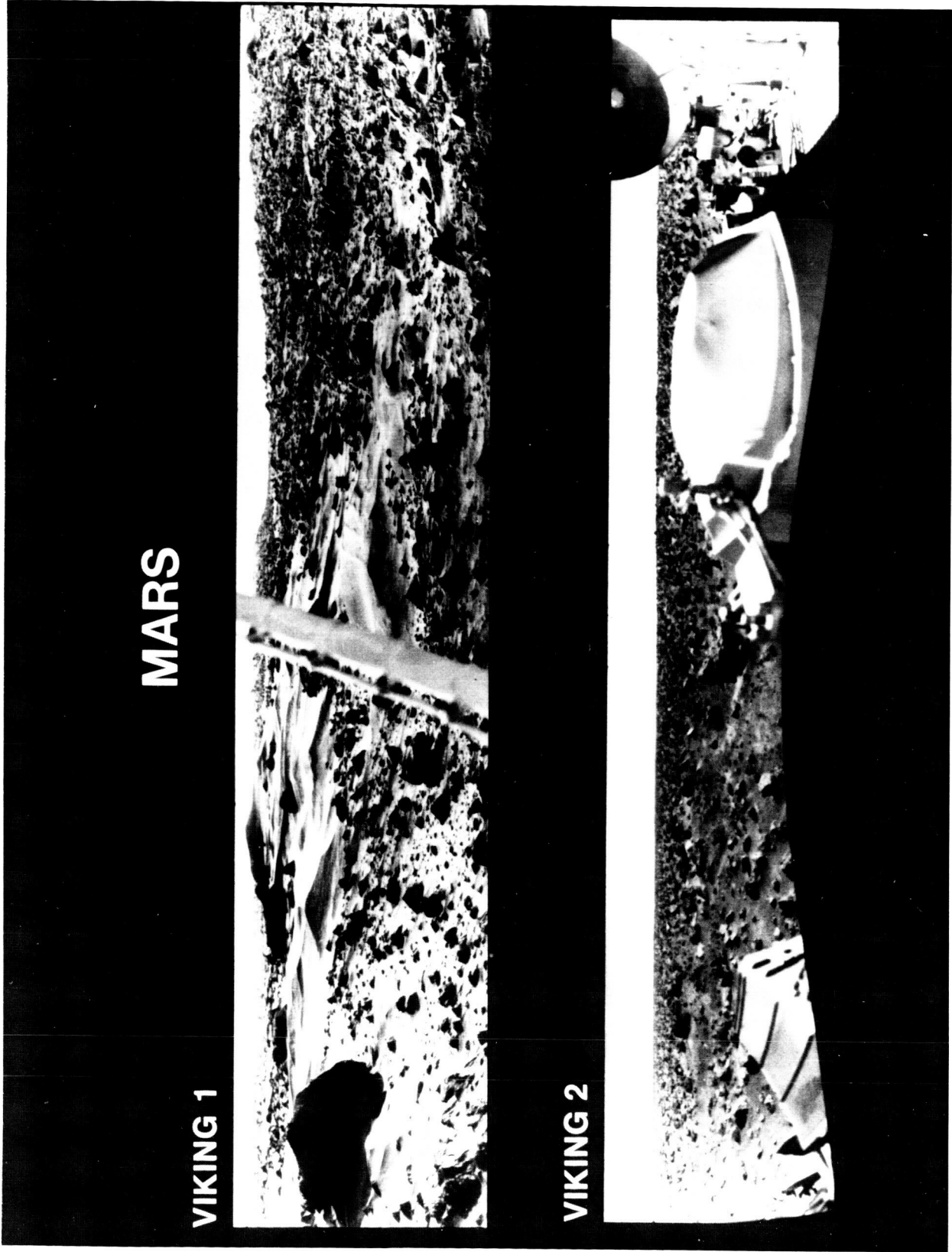


Photo 70 – THE SURFACE OF MARS

83 H 253





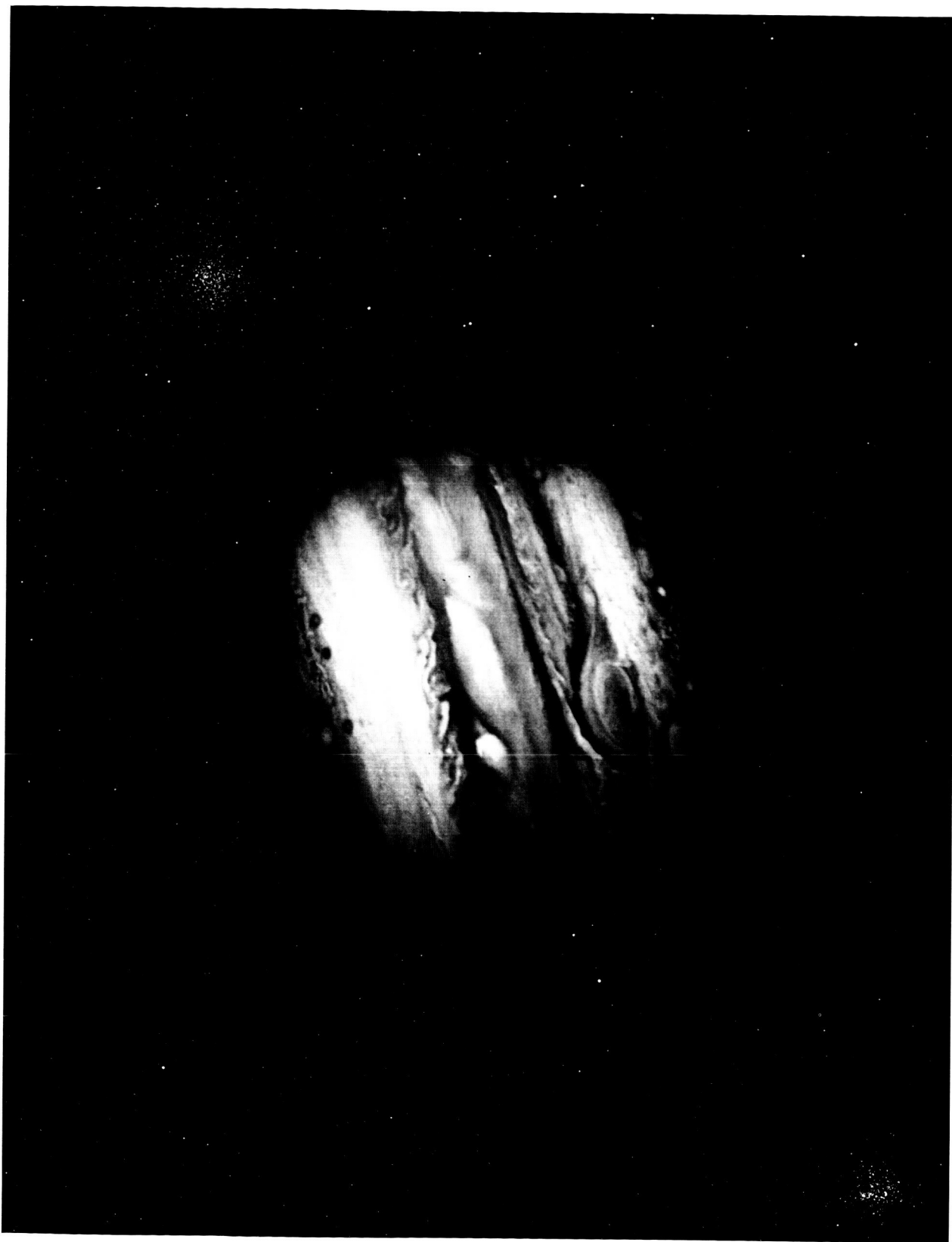


Photo 71 – JUPITER

83 H 215  
83 HC 215

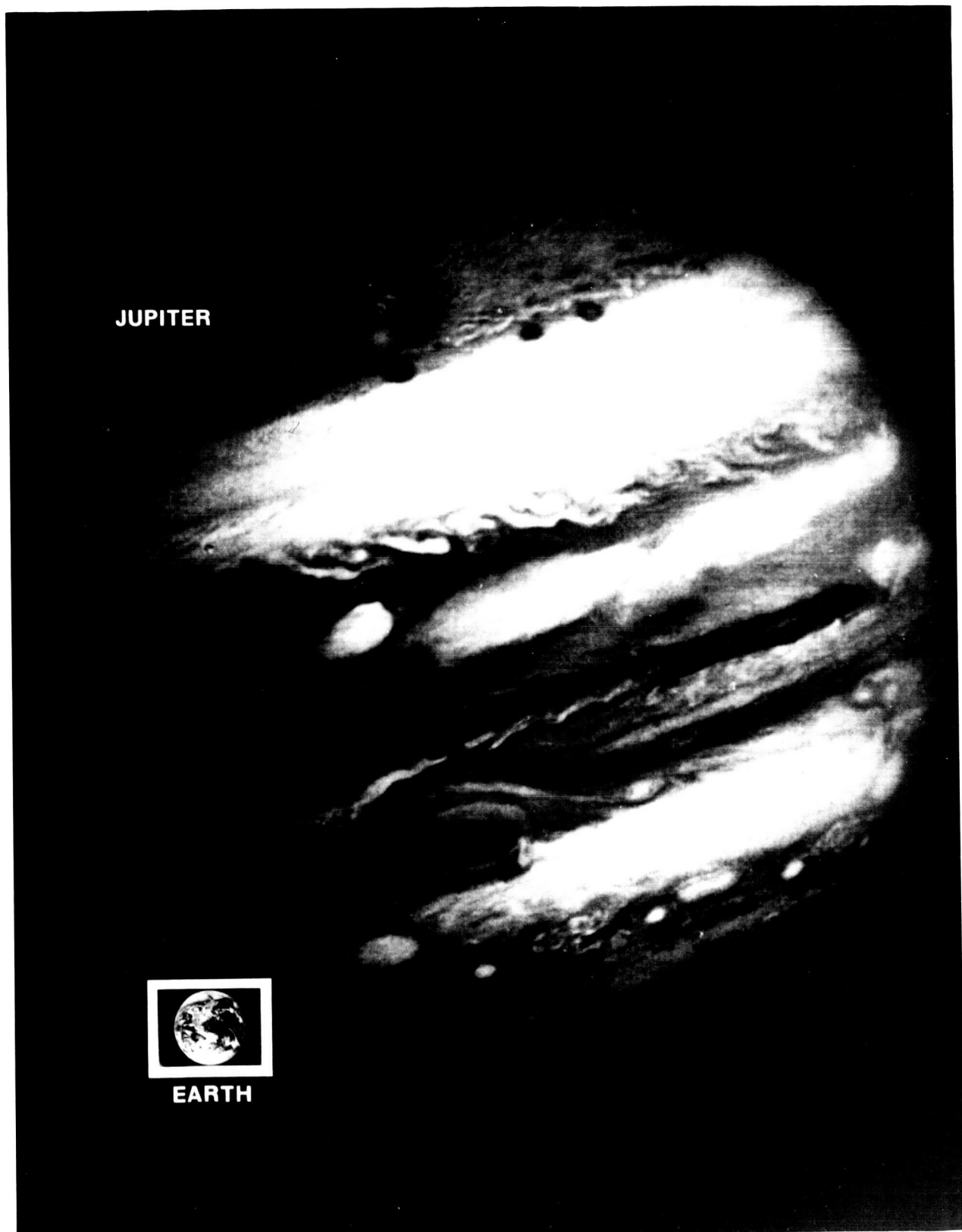


Photo 72 – JUPITER AND EARTH

83 H 231



Photo 73 – THE GREAT RED SPOT

83 H 208  
83 HC 208



Photo 74 – CLOUDS OF JUPITER

83 H 209  
83 HC 209

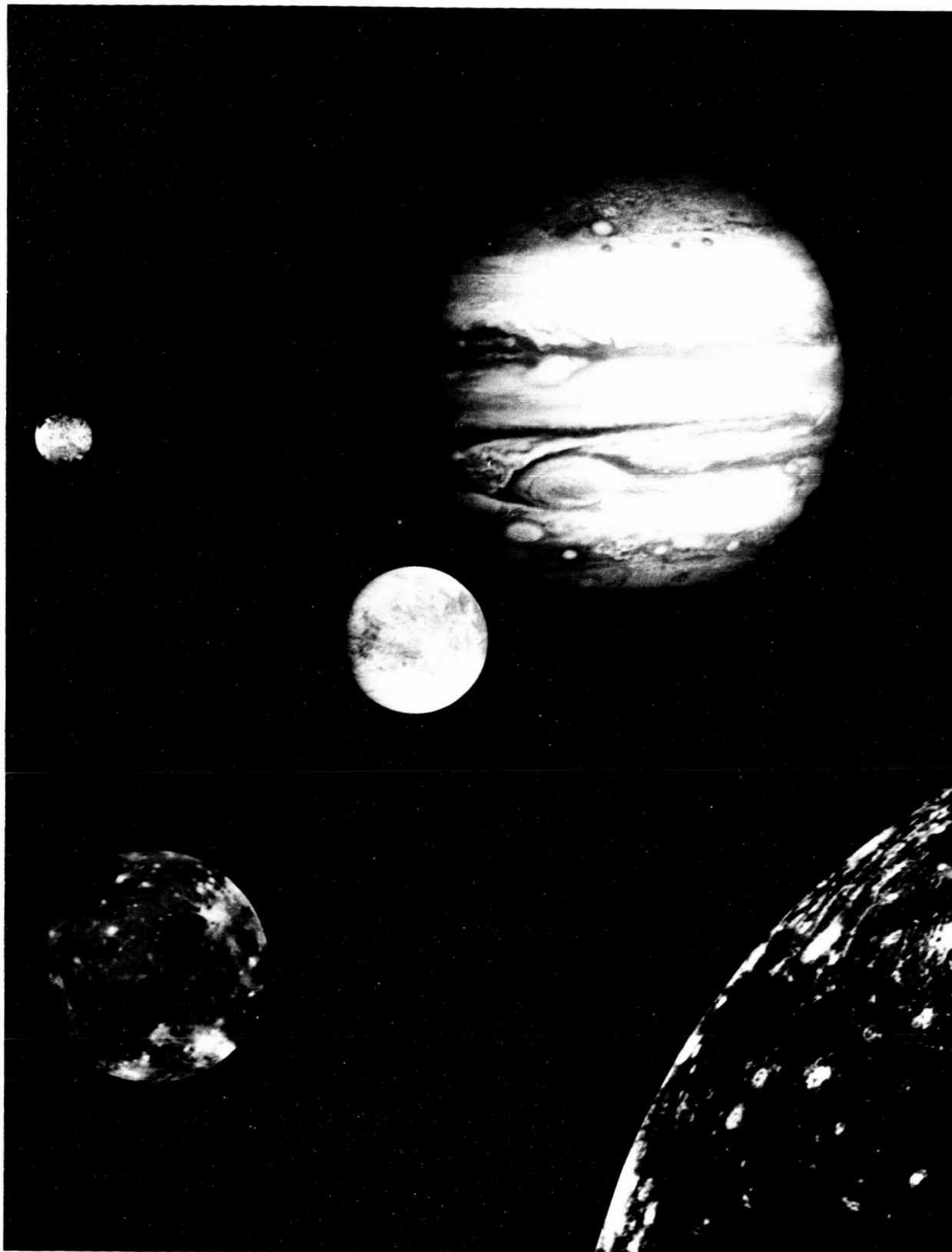


Photo 75 — THE JOVIAN SYSTEM

83 H 220  
83 HC 220

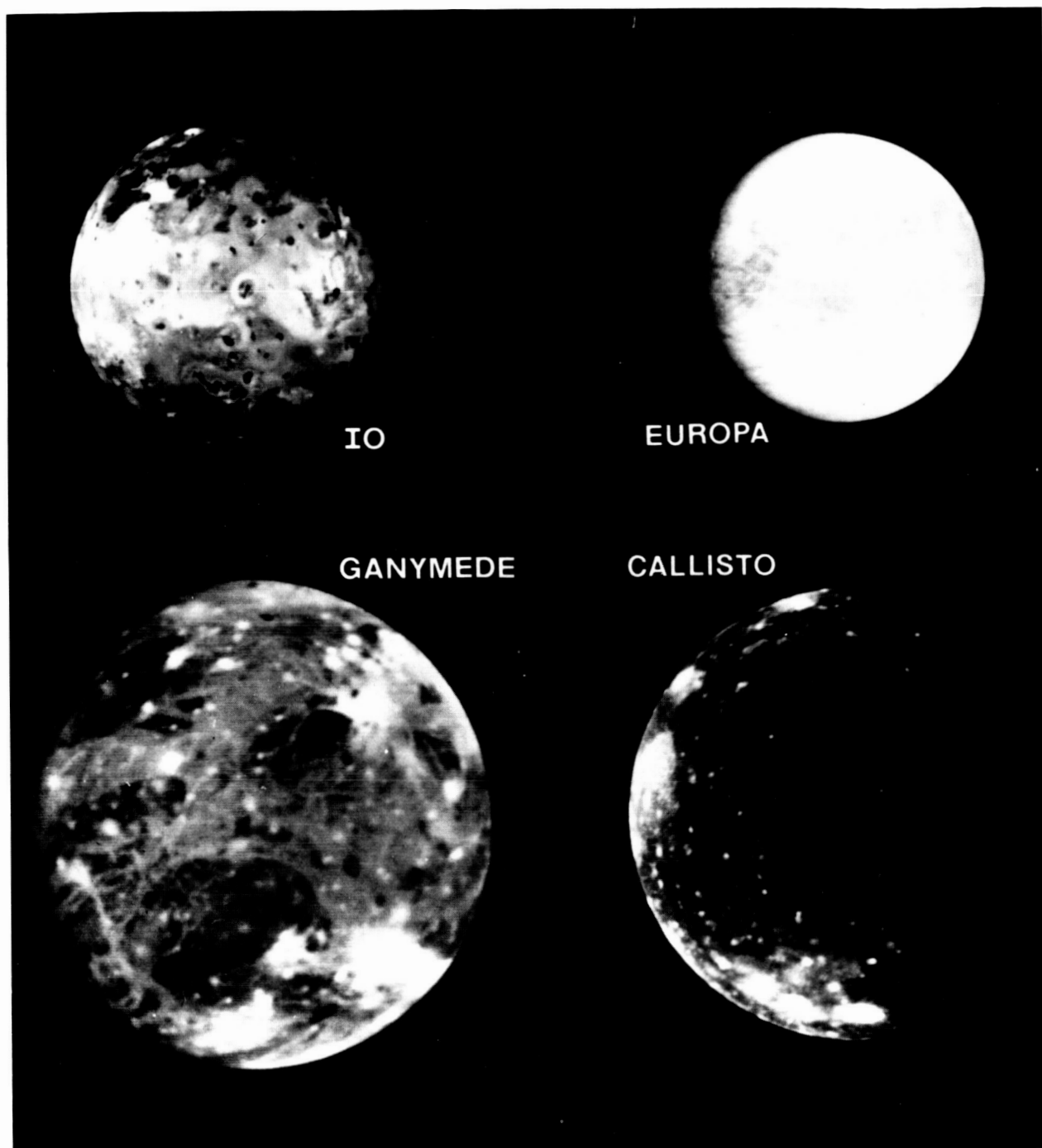
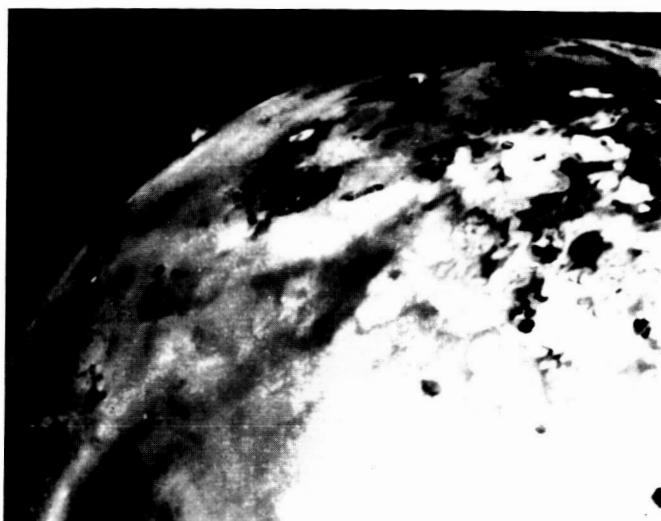


Photo 76 – MOONS OF JUPITER

83 H 205  
83 HC 205

GALILEAN SATELLITES



IO



EUROPA



CALLISTO

GANYMEDE

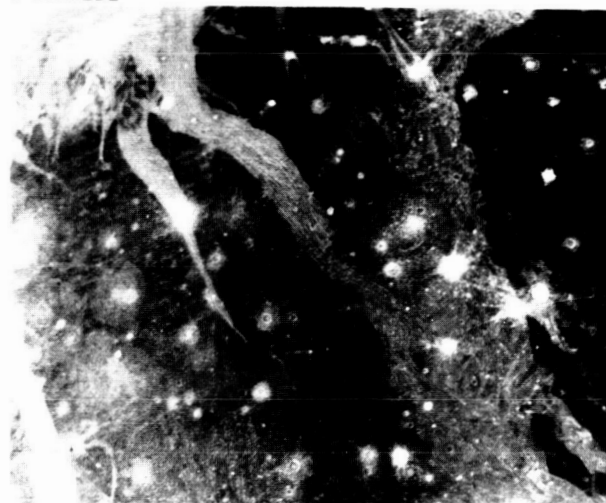


Photo 77 - JUPITER'S MOONS - CLOSEUP

83 H 210  
83 HC 210



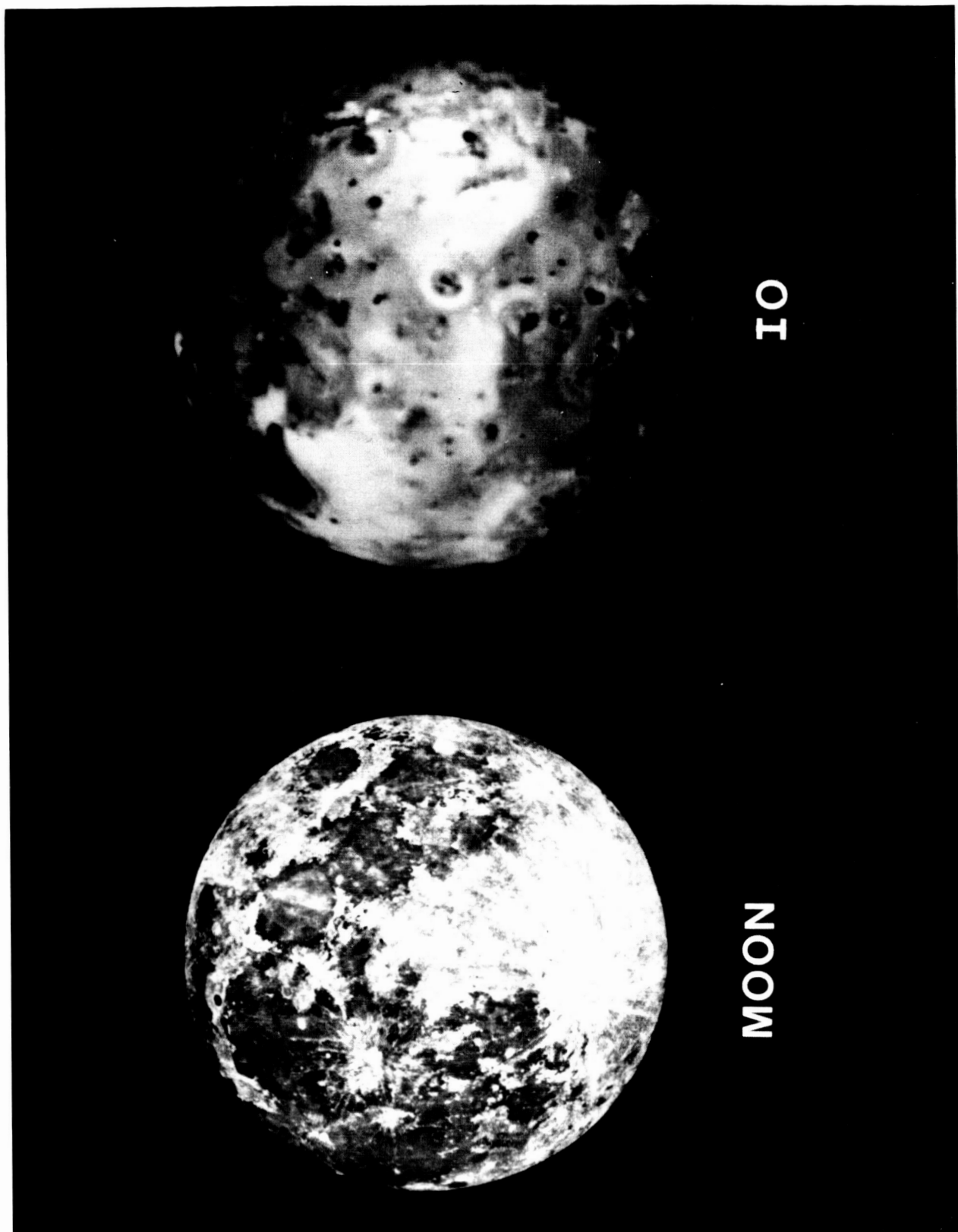


Photo 78 – IO AND THE MOON

83 H 236



Photo 79 – PELE

85 H 61

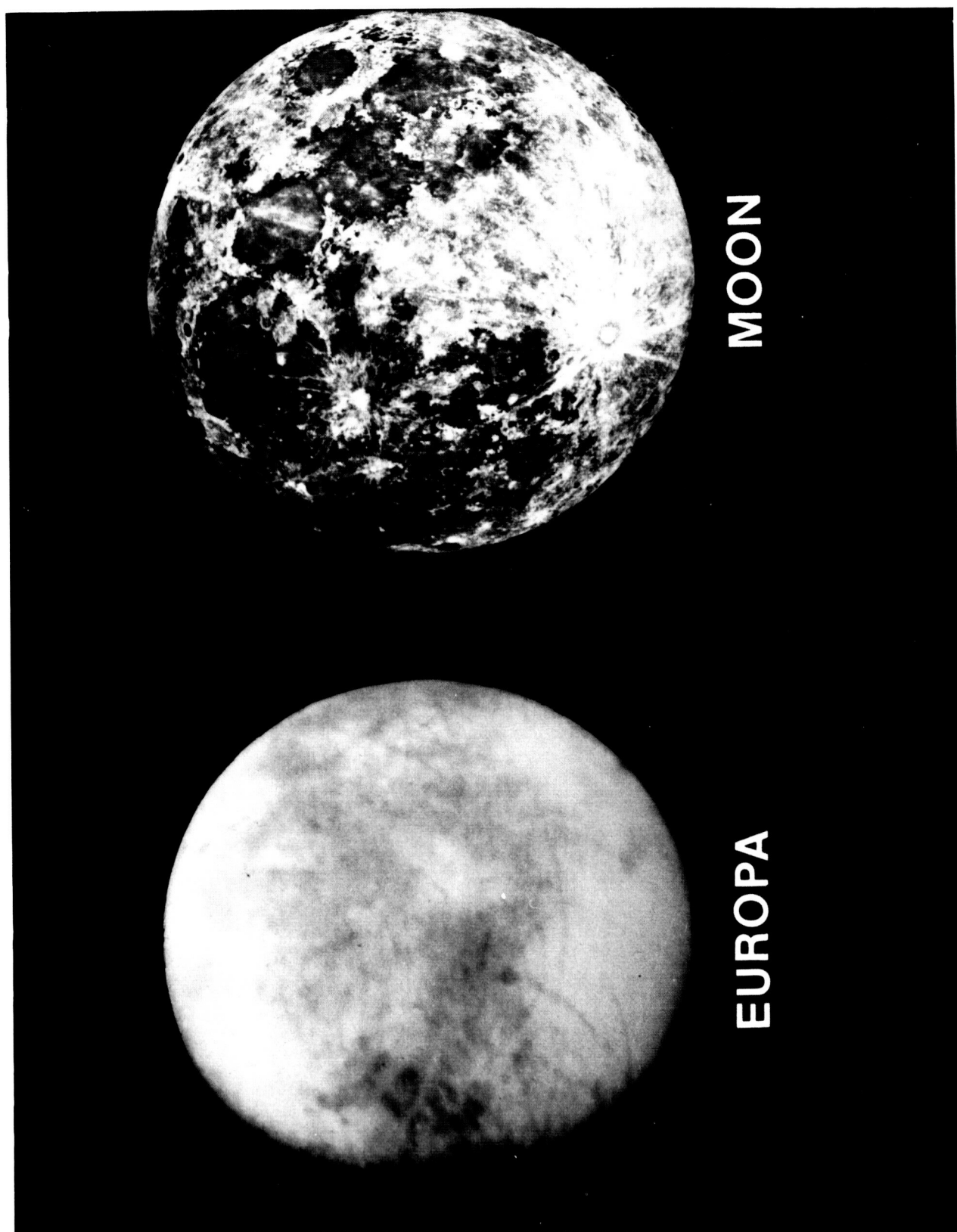


Photo 80 – EUROPA AND THE MOON

83 H 237



Photo 81 — EUROPA COMPARED WITH THE UNITED STATES

85 H 62

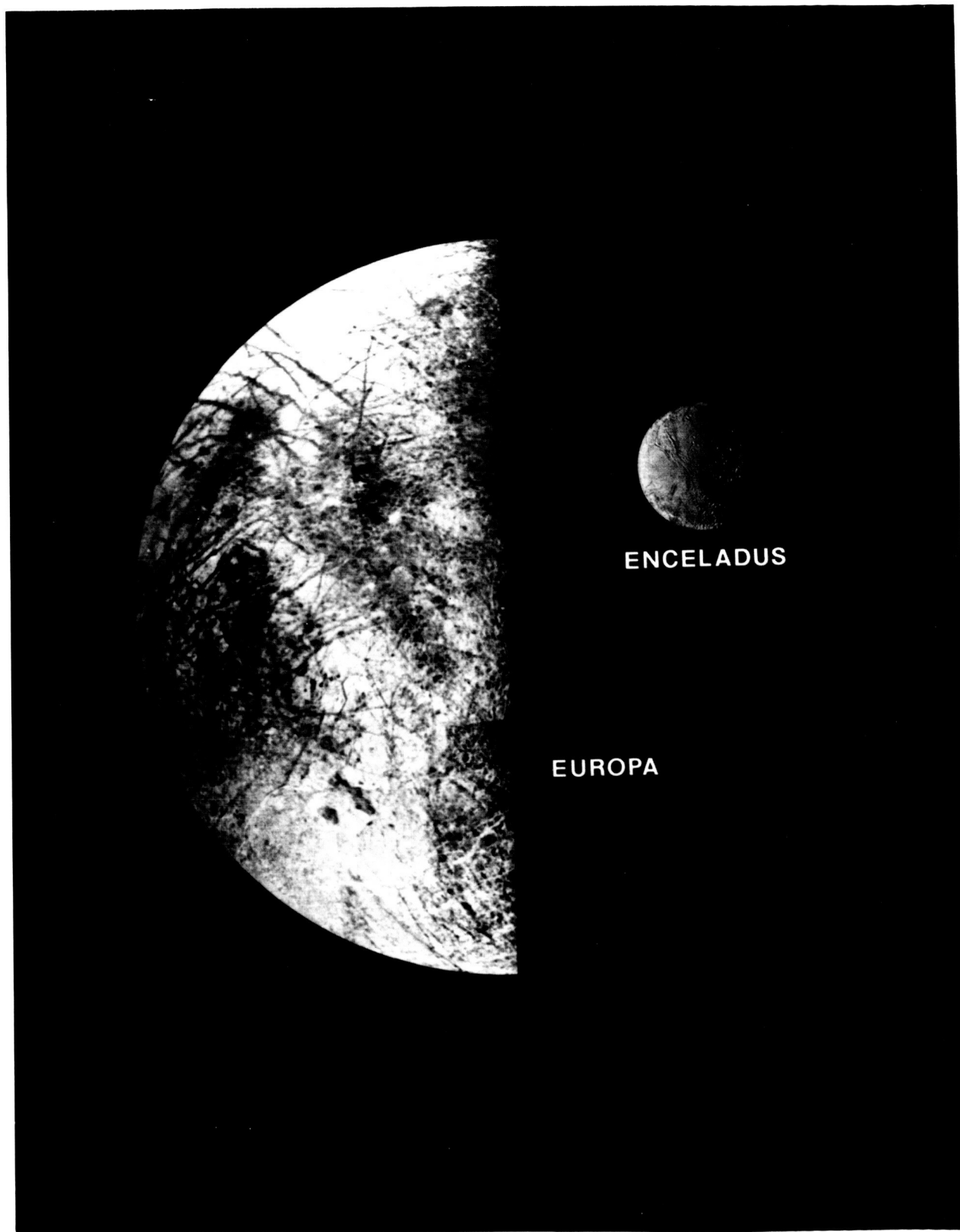


Photo 82 – EUROPA AND ENCELADUS

84 H 429

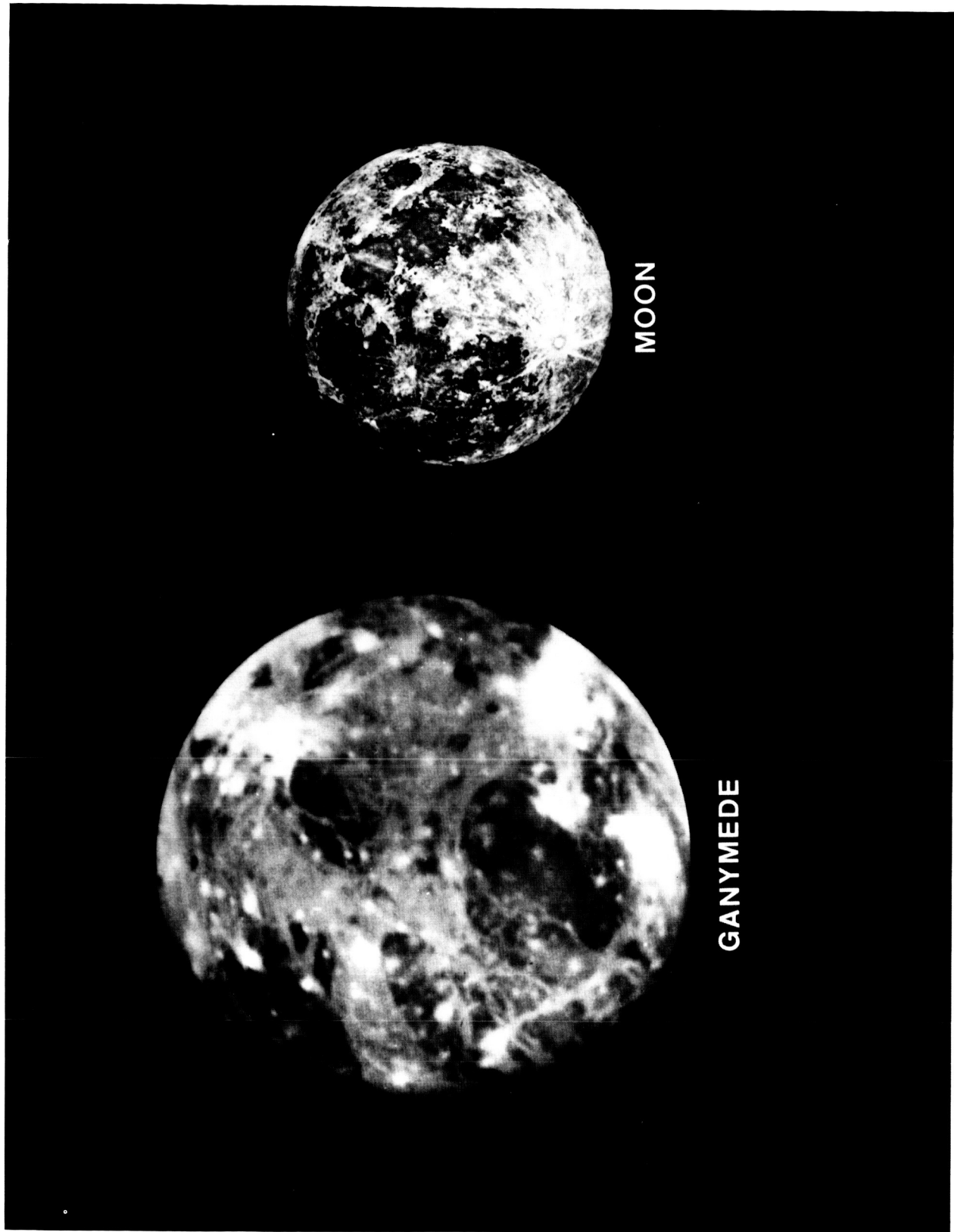


Photo 83 – GANYMEDE AND THE MOON

83 H 238



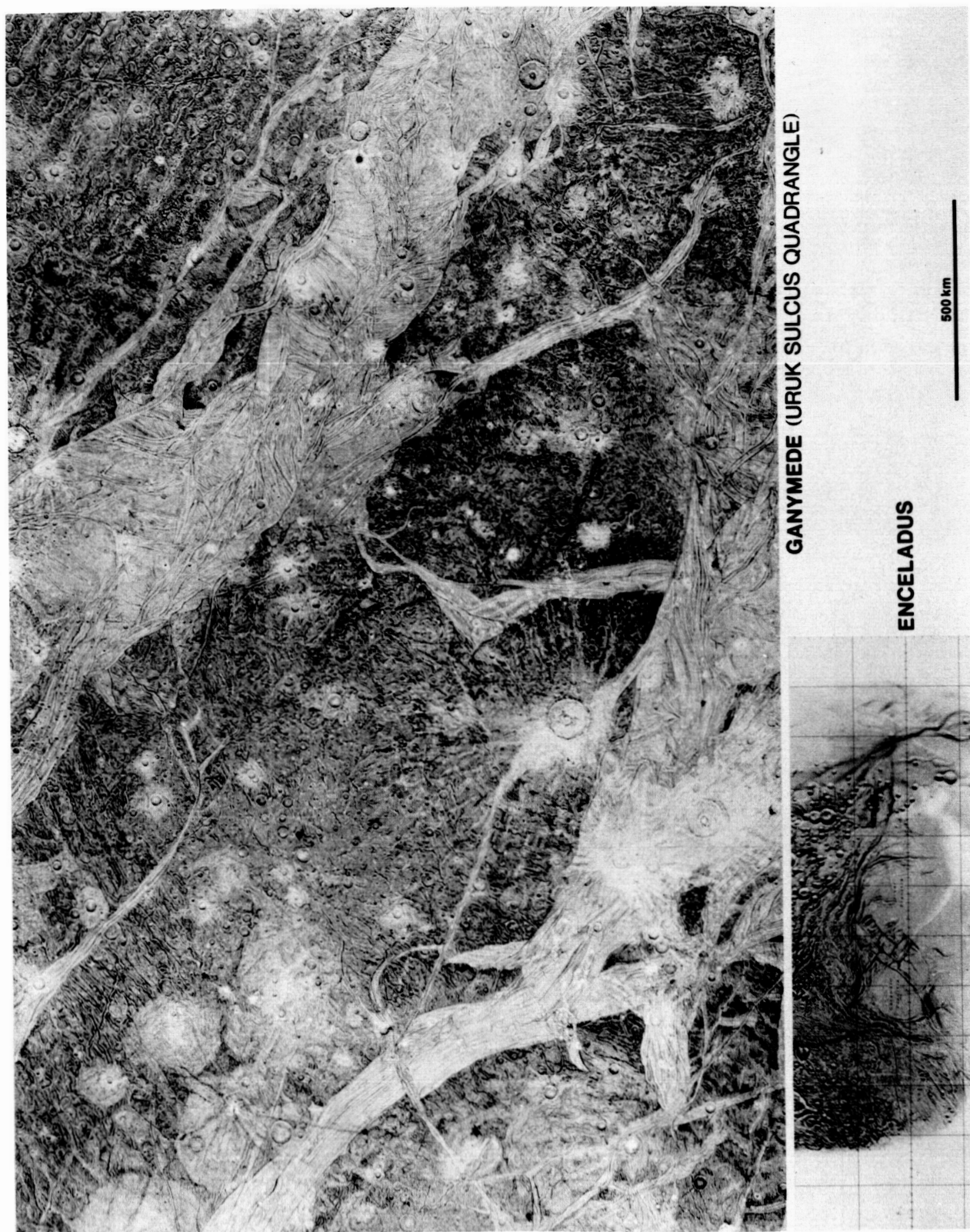


Photo 84 – REGIONS OF GANYMEDE AND ENCELADUS COMPARED

85 H 63



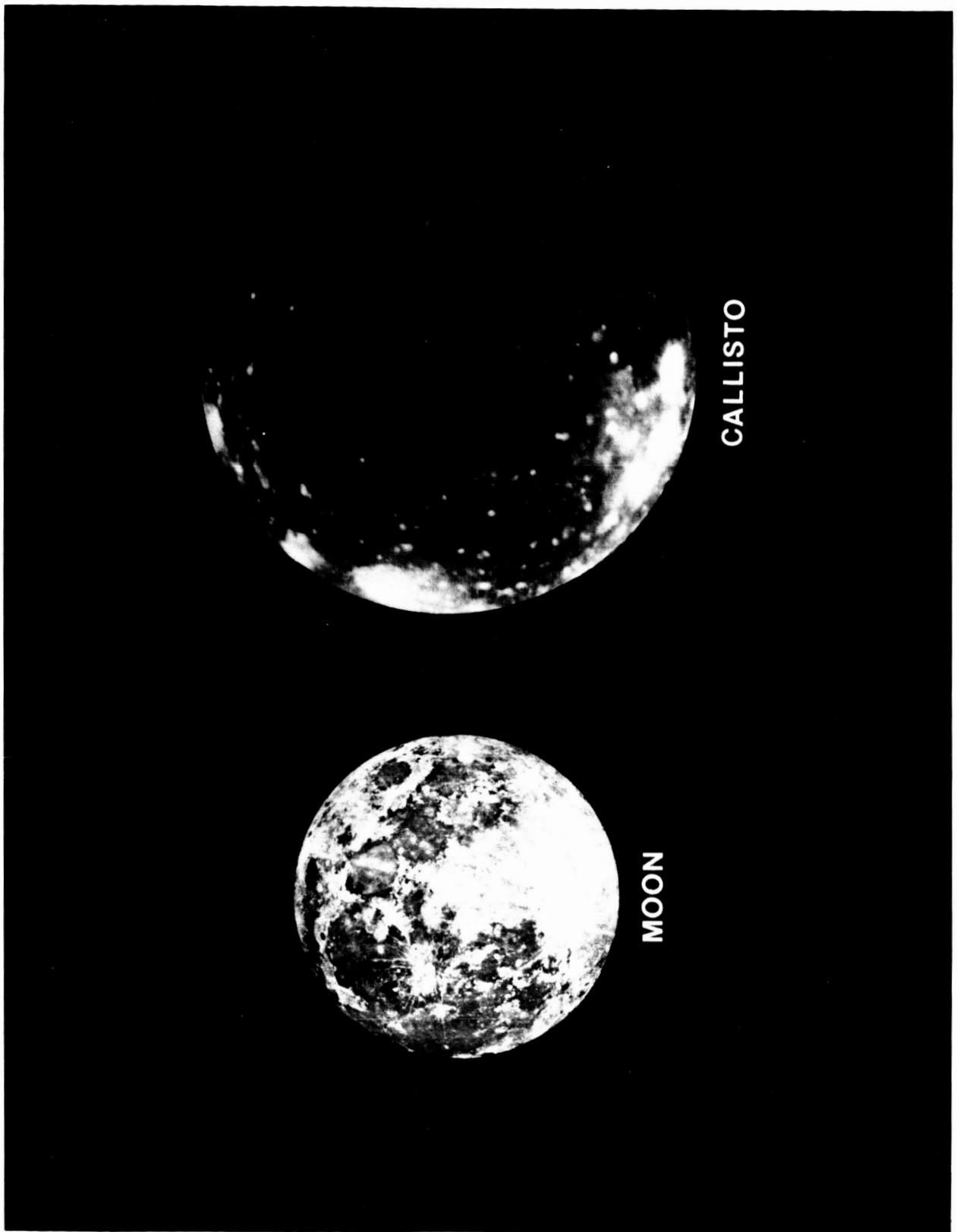


Photo 85 – CALLISTO AND THE MOON

83 H 239

Part II: PHOTOGRAPHIC COMPARISONS

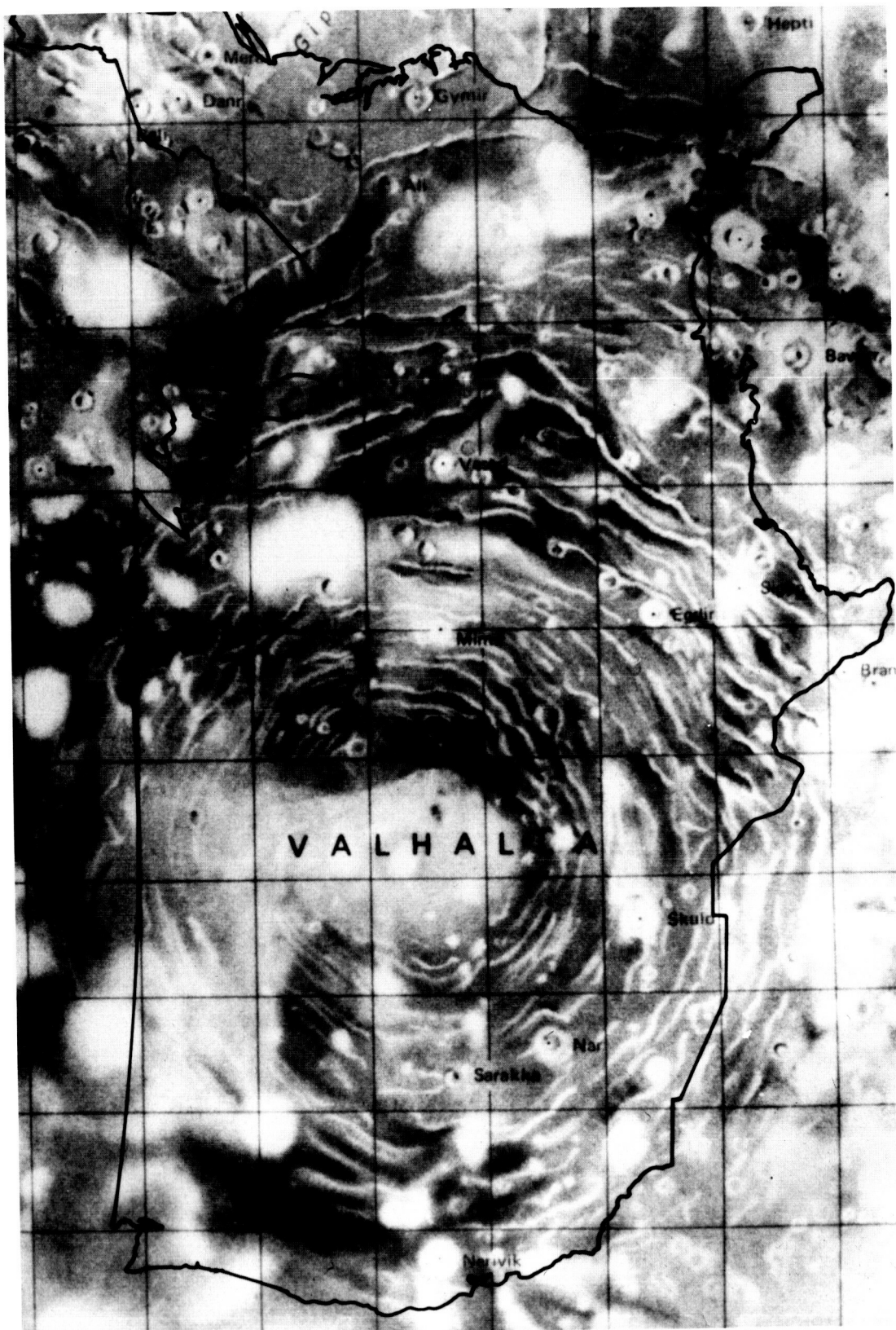


Photo 86 – VALHALLA

85 H 64

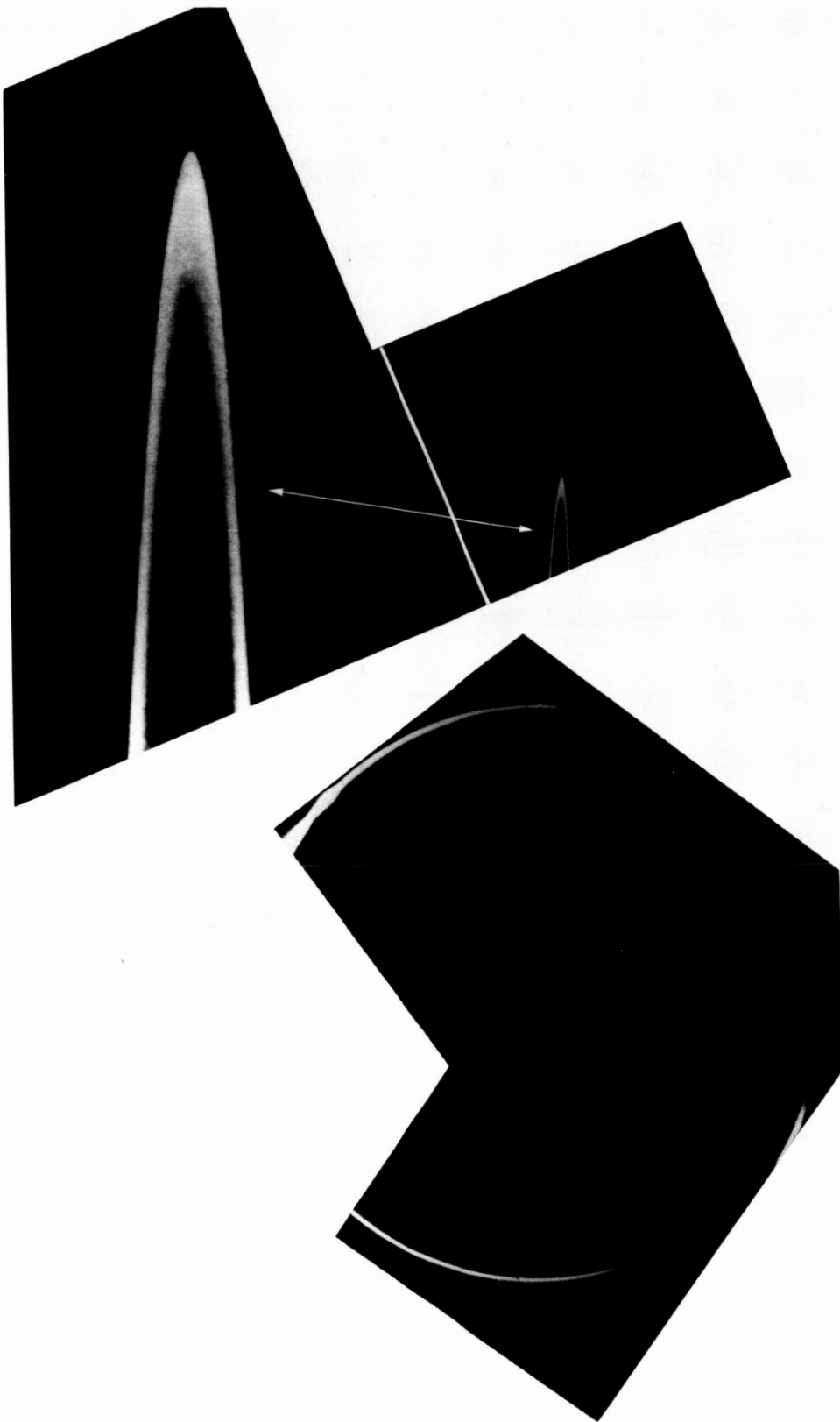


Photo 87 – JUPITER'S RING

83 H 250





Photo 88 – SATURN

83 H 216  
83 HC 216

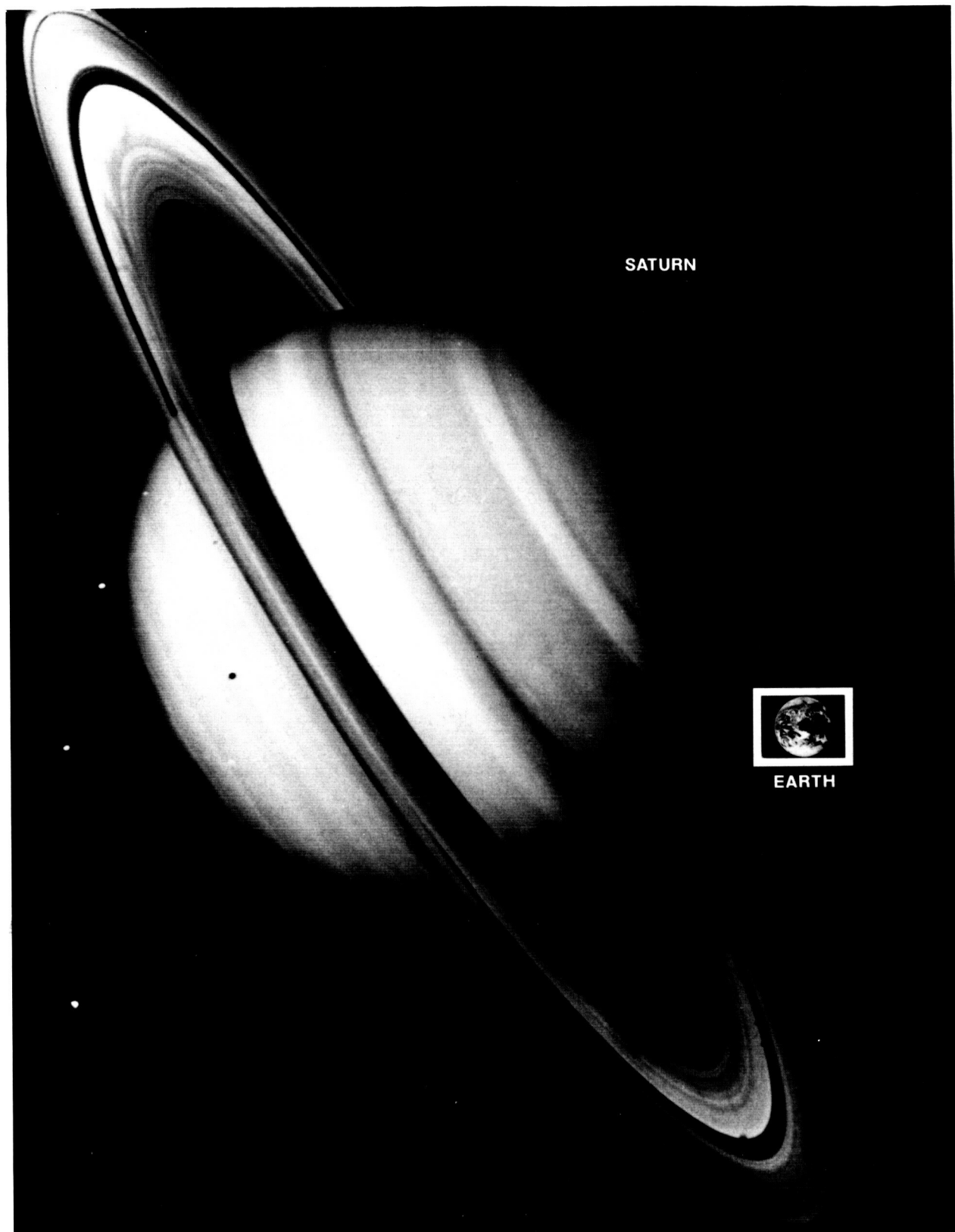


Photo 89 – SATURN AND EARTH

83 H 232



Photo 90 – SATURN AND THE EARTH-MOON DISTANCE

85 H 65



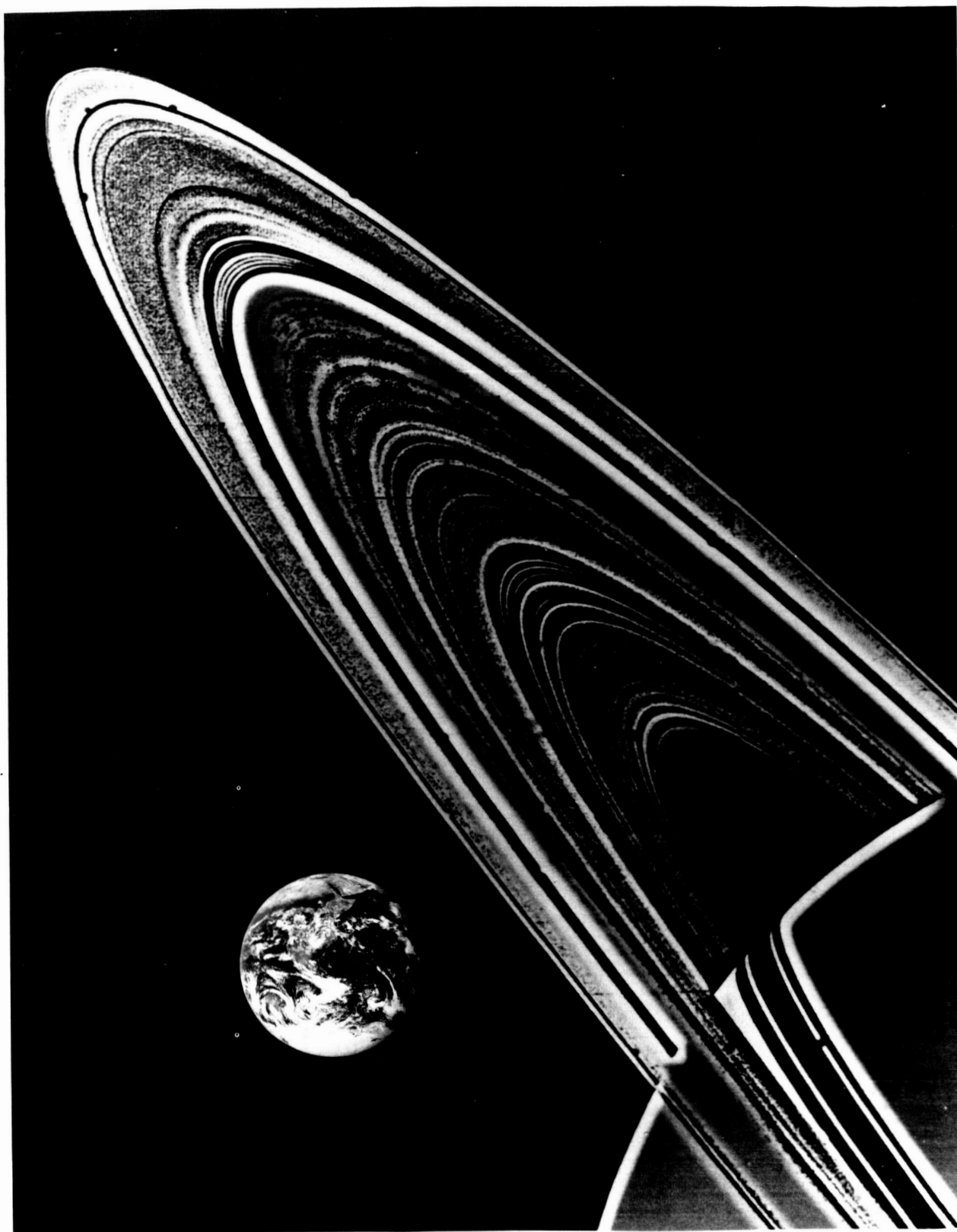


Photo 91 – THE RINGS OF SATURN (#1)

83 H 251

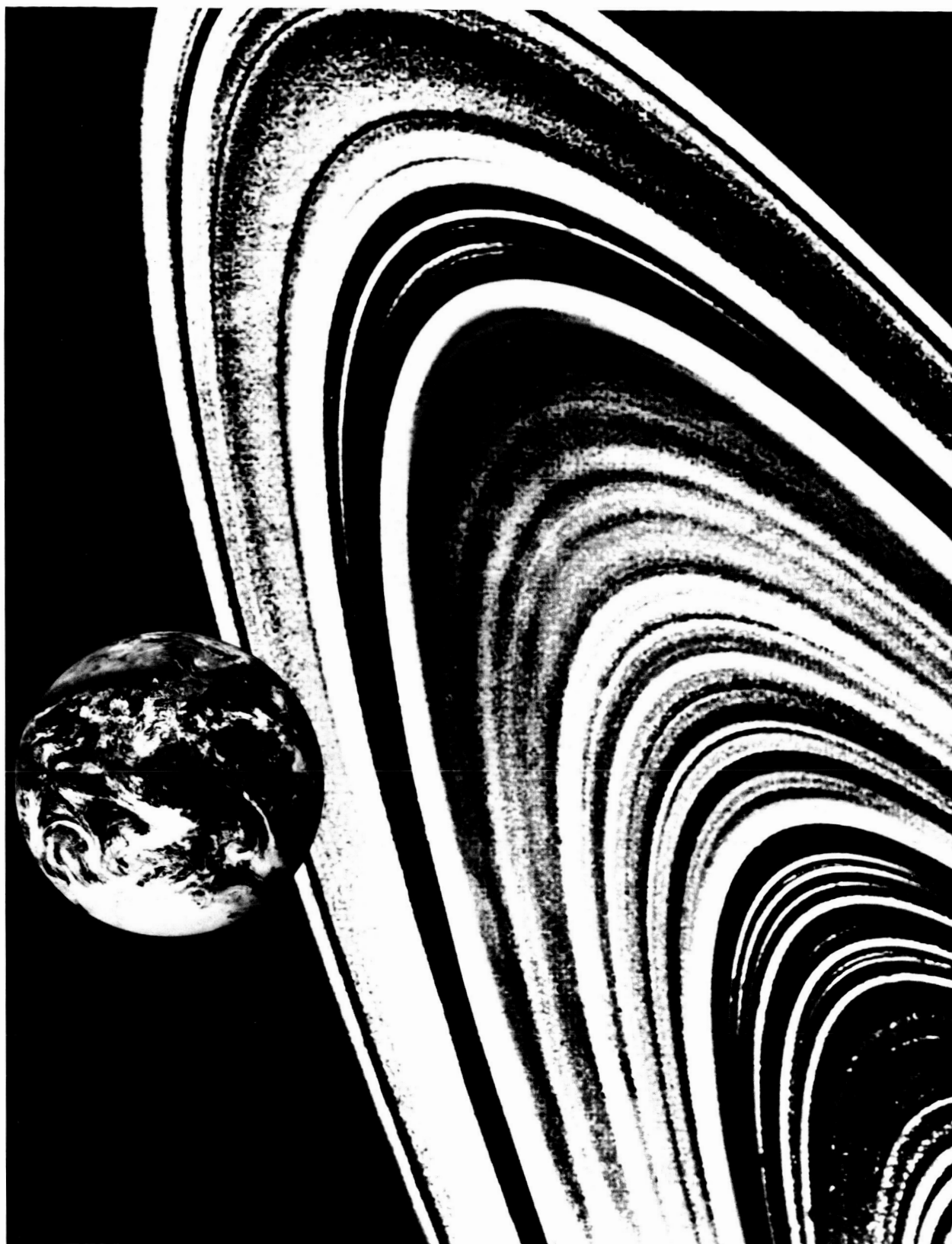


Photo 92 – THE RINGS OF SATURN (#2)

83 H 211  
83 HC 211

## SPOKES IN SATURN'S RINGS

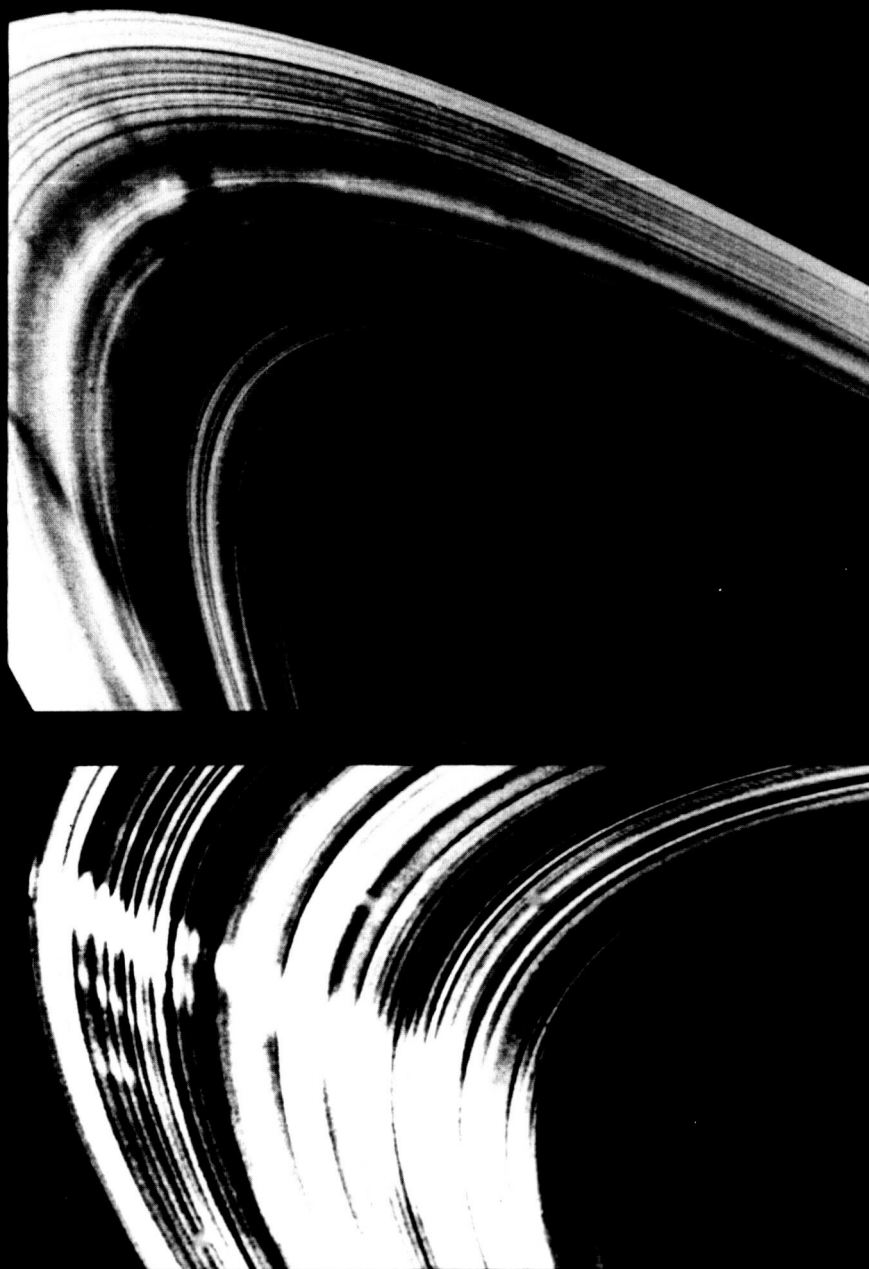


Photo 93 – SPOKES IN SATURN'S RINGS

83 H 252

# RINGED PLANET COMPARISONS

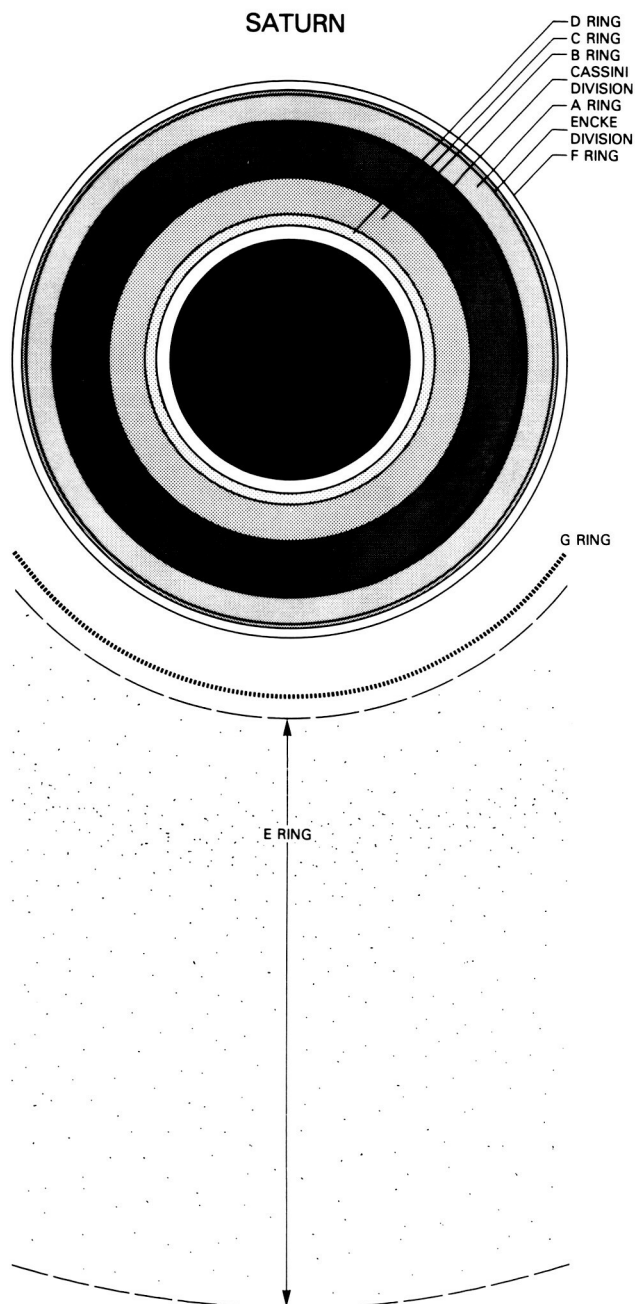
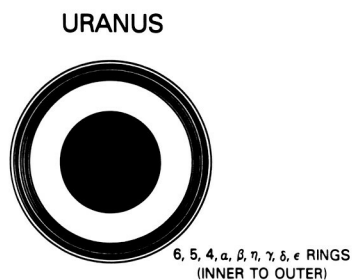
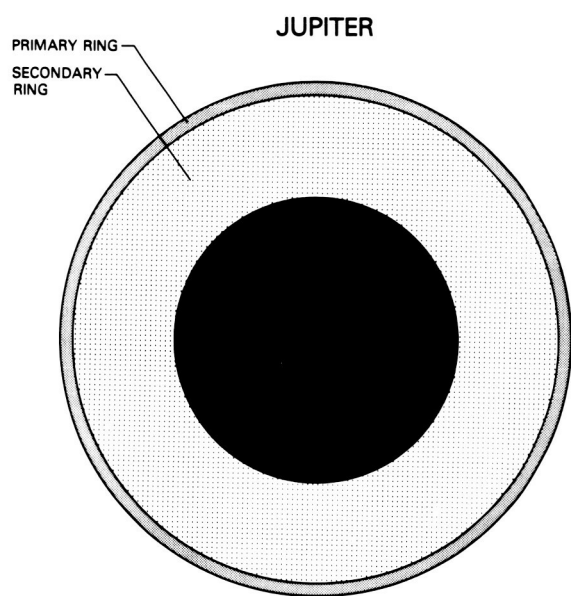






Photo 95 – THE SATURNIAN SYSTEM

83 H 221  
83 HC 221

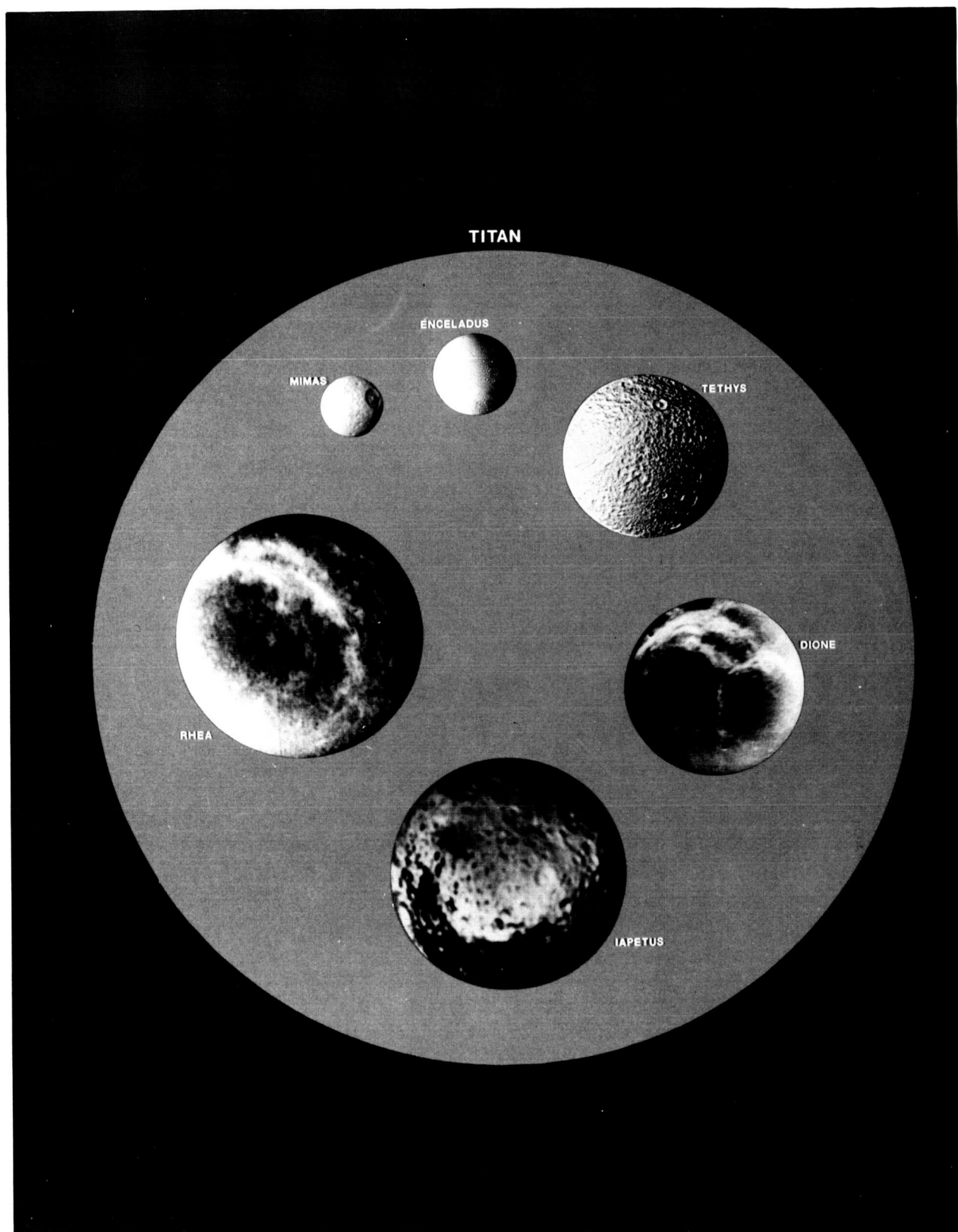


Photo 96 – THE MOONS OF SATURN

83 H 223



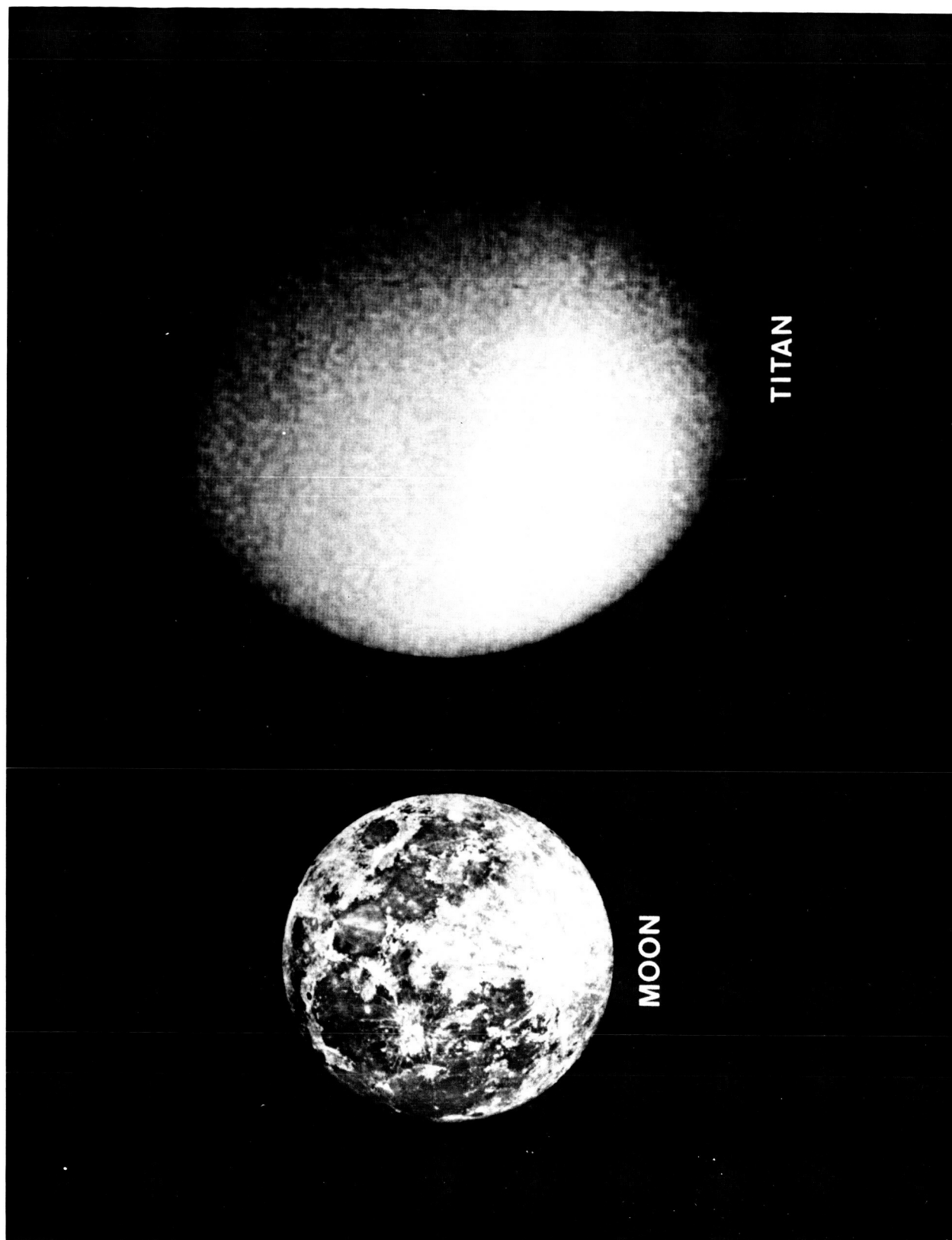


Photo 97 – TITAN AND THE MOON

83 H 240

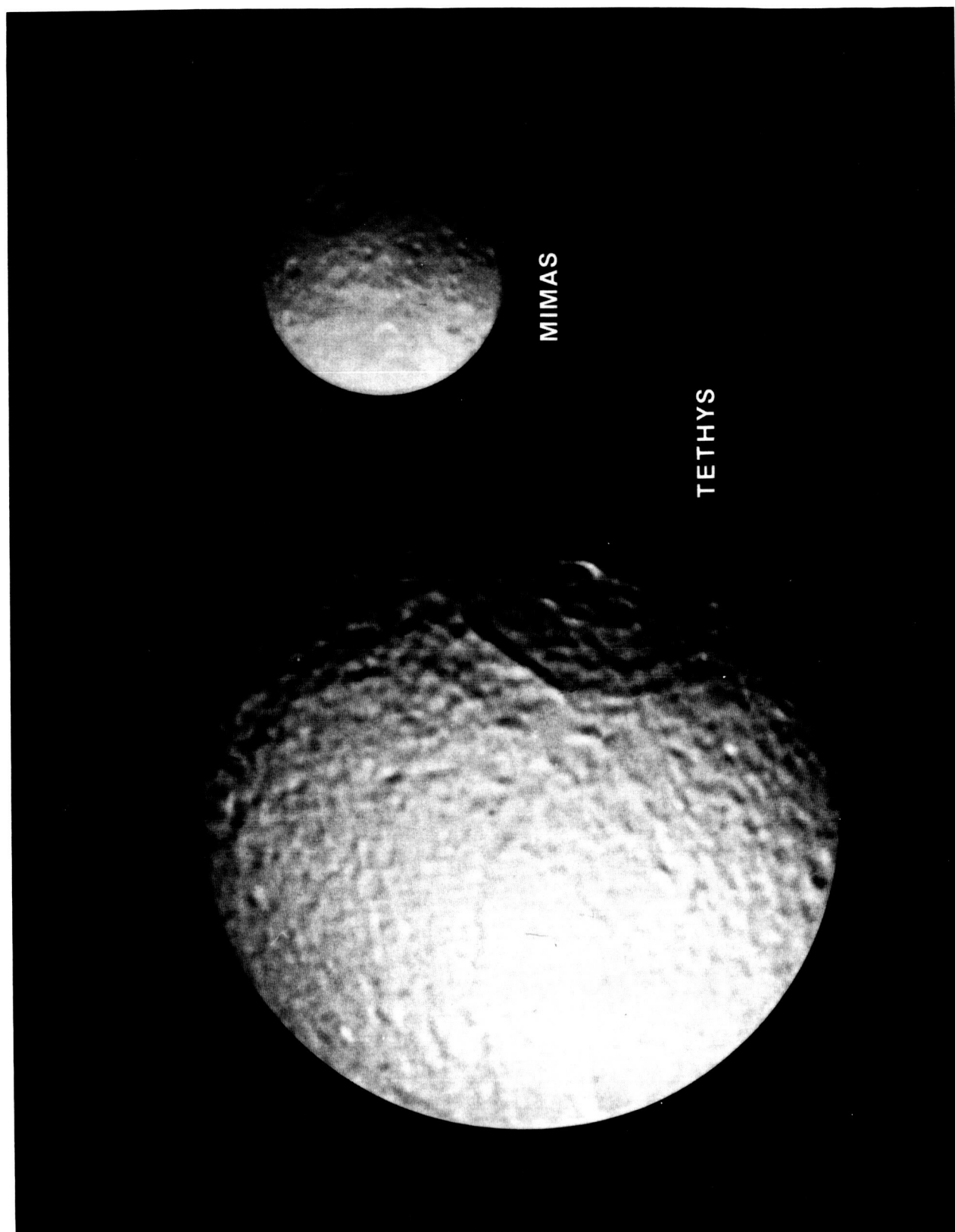


Photo 98 – MIMAS AND TETHYS

84 H 421

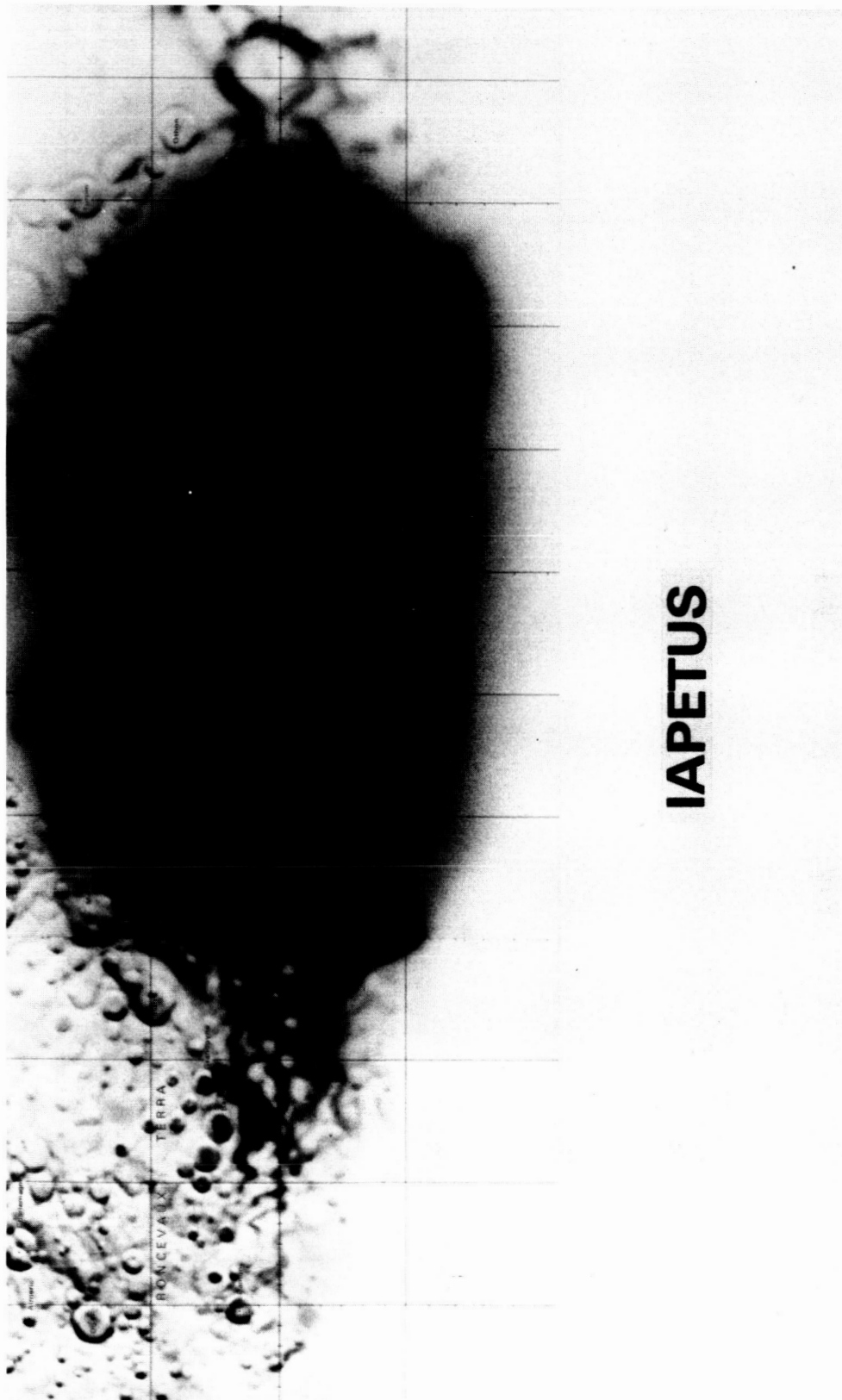


Photo 99 – IAPETUS (#1)

85 H 67

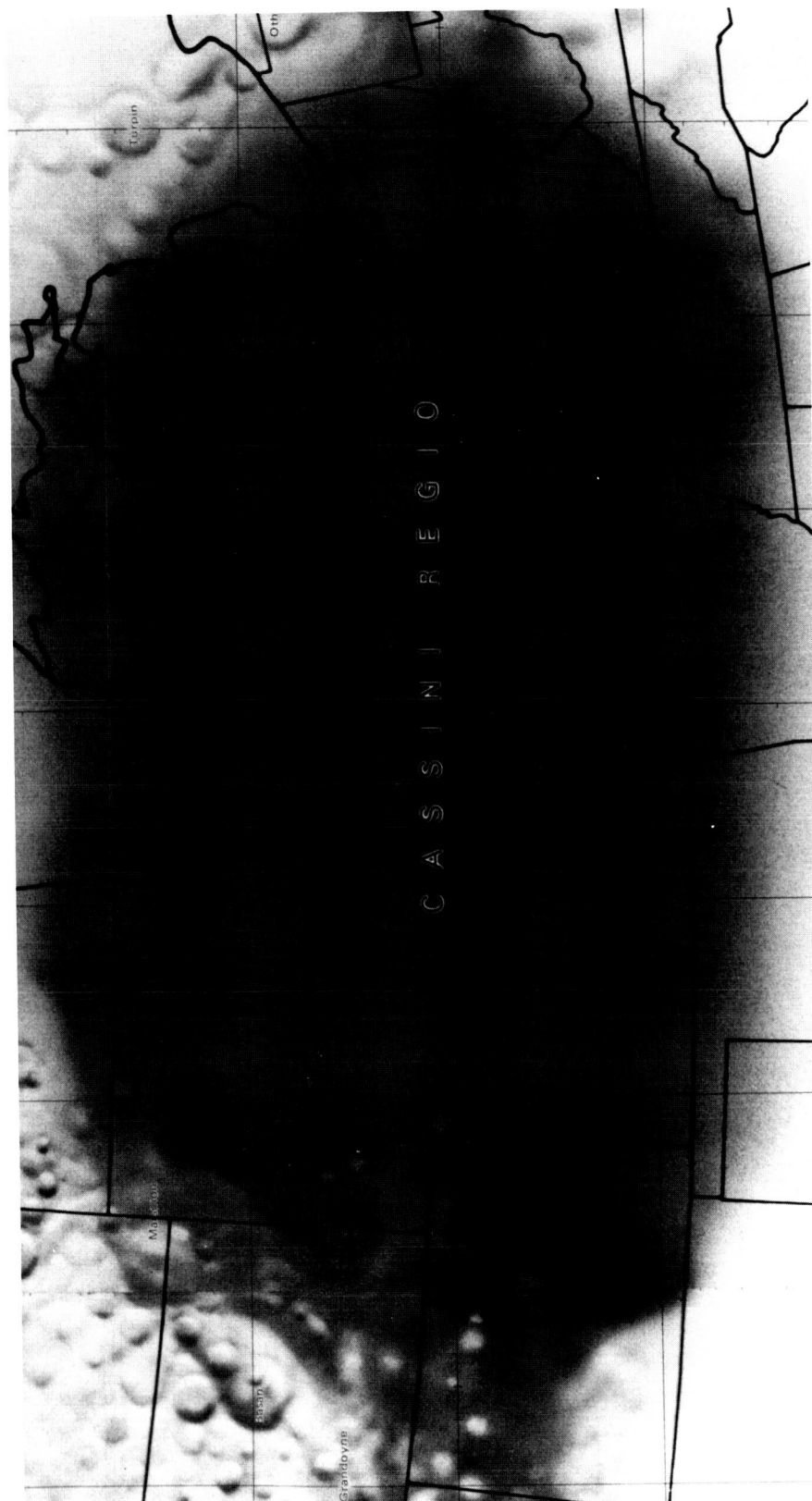


Photo 100 – IAPETUS (#2): CASSINI REGIO

85 H 68

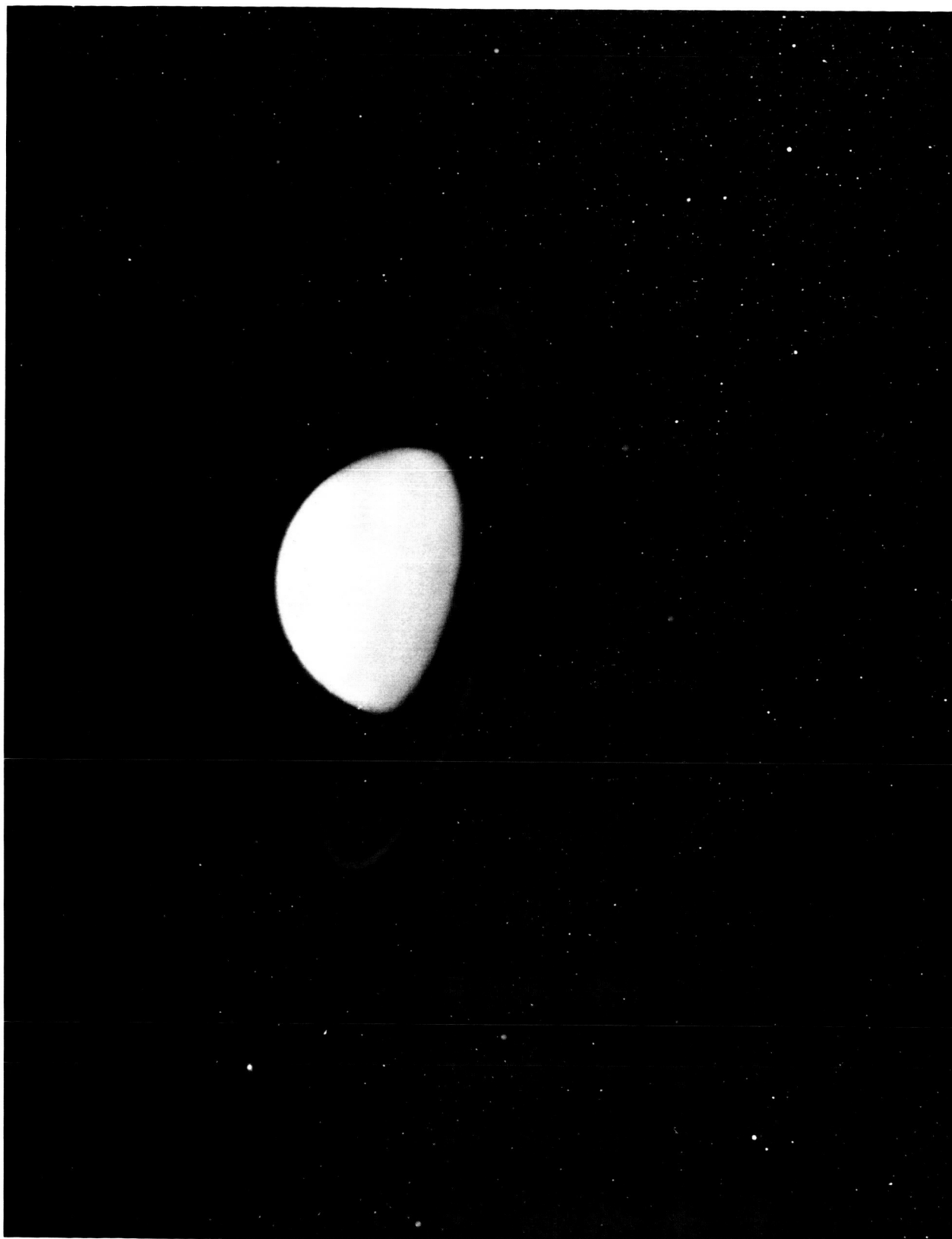


Photo 101 – URANUS

83 H 217  
83 HC 217

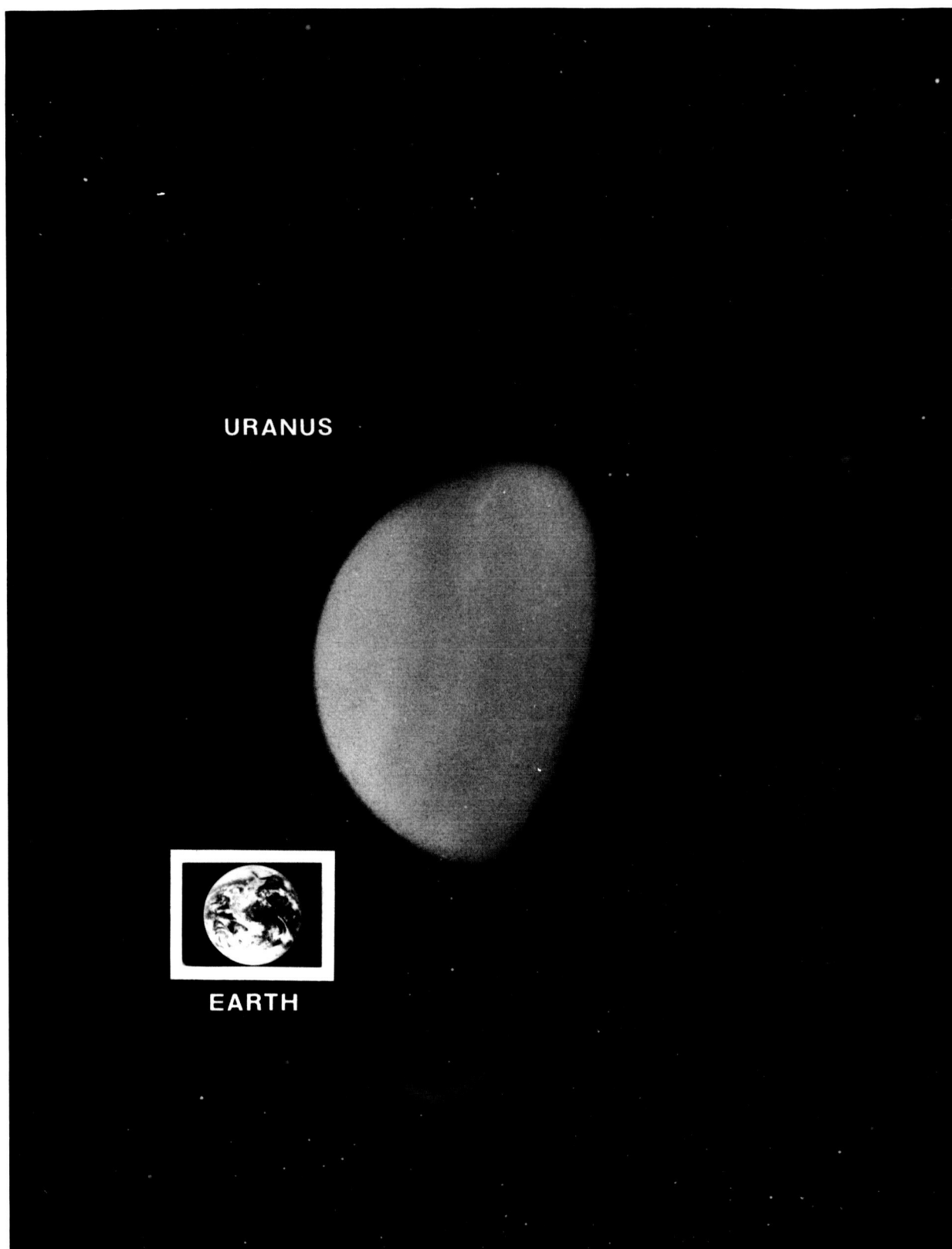


Photo 102 – URANUS AND EARTH

83 H 233

NEPTUNE

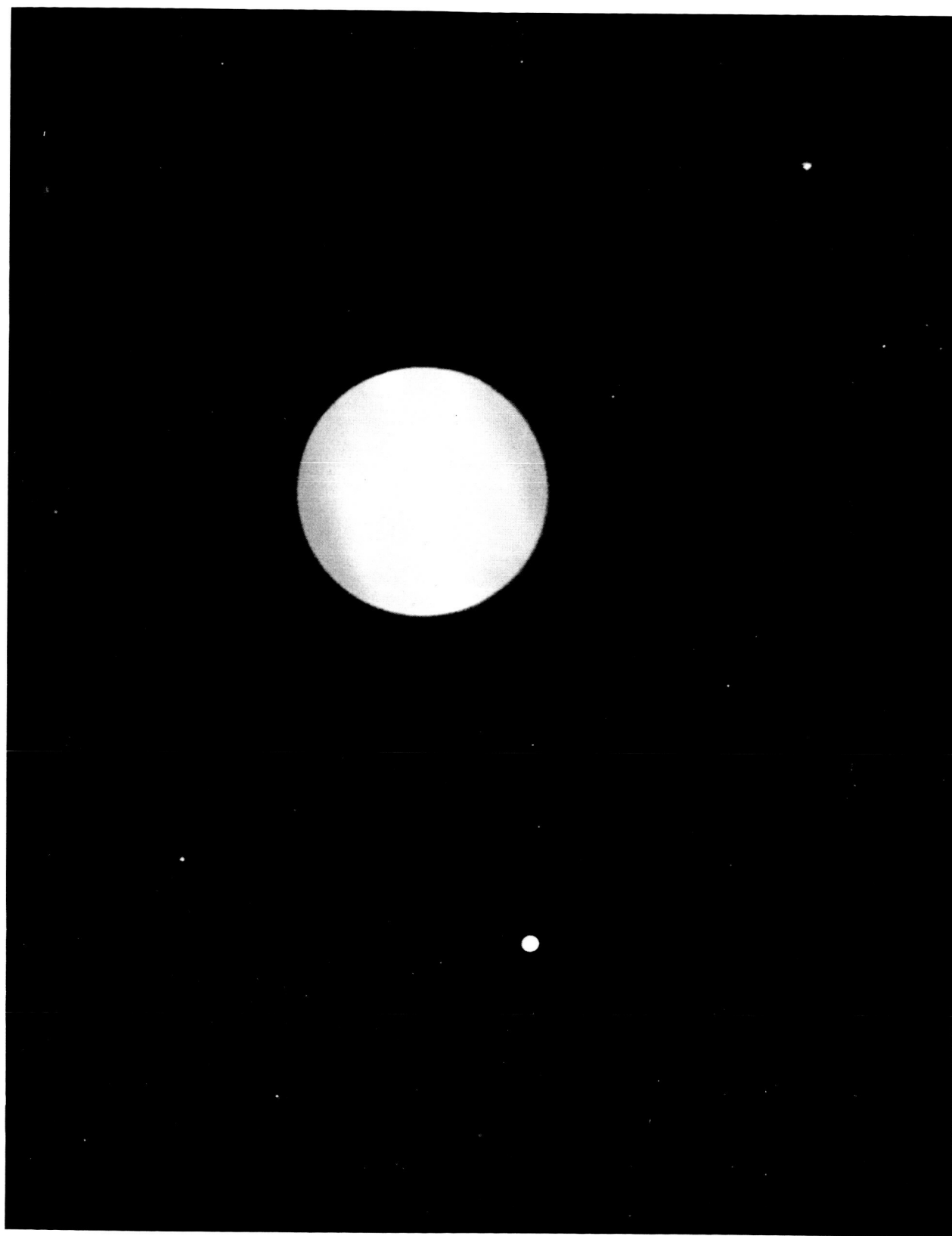


Photo 103 – NEPTUNE

83 H 218  
83 HC 218



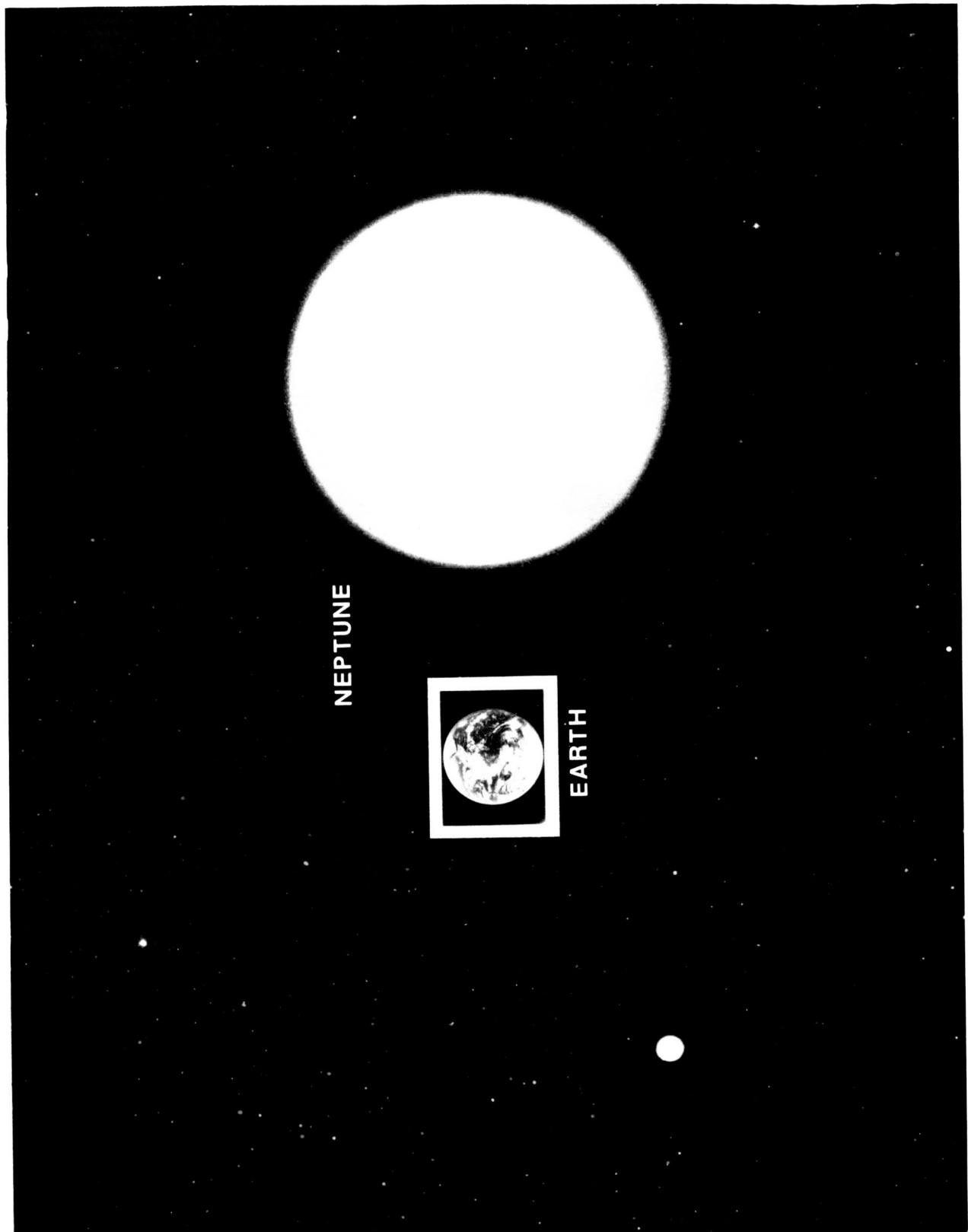


Photo 104 – NEPTUNE AND EARTH

83 H 234

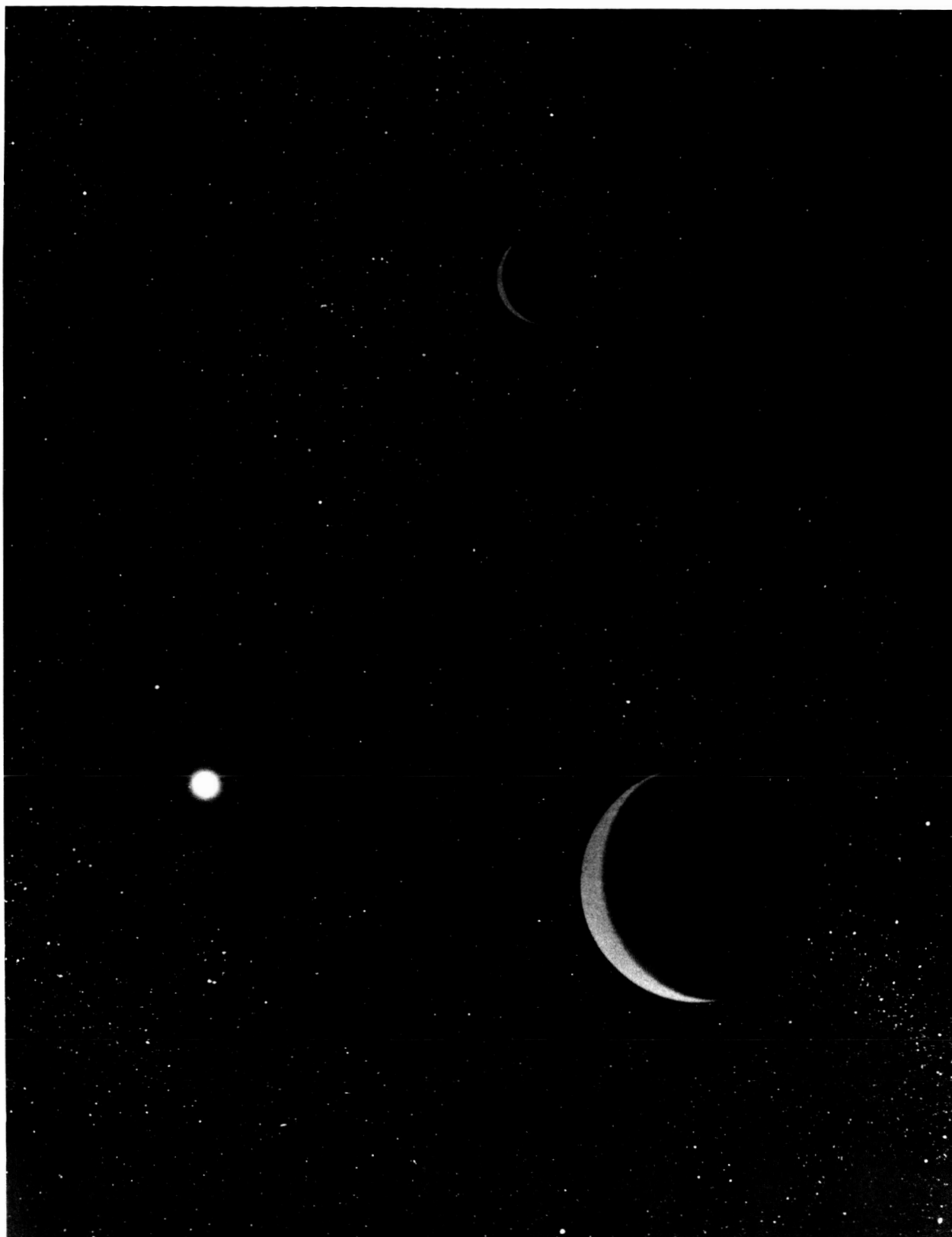


Photo 105 – PLUTO

83 H 219  
83 HC 219

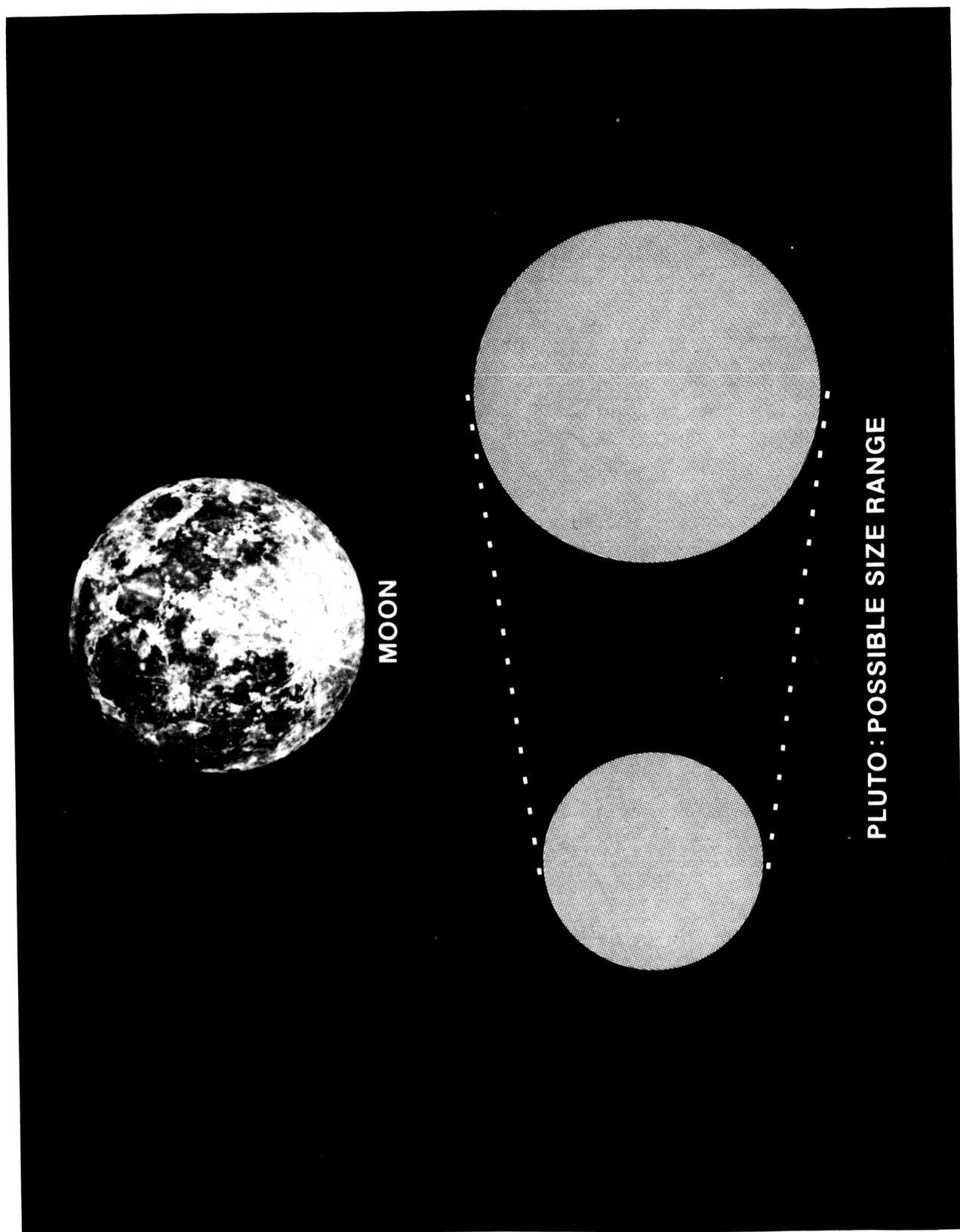


Photo 106 – PLUTO SIZE RANGE

83 H 235

Part III

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